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EDITORIAL ANNOUNCEMENTS.

THE BRITISH AND EASTERN CONTINENTS edition of the Railroad Gazette is published each Friday at Queen Anne's Chambers, Westminster, London. It contains selected reading pages from the Railroad Gazette, together with additional British and foreign matter, and is issued under the name Railway Gazette.

CONTRIBUTIONS.—Subscribers and others will materially assist in making our news accurate and complete if they will send early information of events which take place under their observation. Discussions of subjects pertaining to all departments of railroad business by men practically acquainted with them are especially desired.

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

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VOL. XLIII., No. 10. FRIDAY, SEPTEMBER 6, 1907.

ELECTRIFICATION ON THE SOUTHERN PACIFIC.

The Southern Pacific has directed its electrical engineer, Allen H. Babcock, and Frank J. Sprague, who has been retained as consulting engineer, to study the possibilities of increasing the capacity of the Sacramento division of the old Central Pacific by electrifying between Rocklin, Cal., and Sparks, Nev., 134 miles over the Sierra Nevada mountains. These gentlemen constitute a sub-committee within a committee of five, consisting of themselves and three engineers of the Harriman lines, not yet named. This committee will consider the relative advantages of a number of proposed plans for relieving the present congestion of traffic over this important connecting link between the Union Pacific and the Southern Pacific coast lines, and will make final recommendations to Mr. Kruttschnitt, Director of Maintenance and Operation of the Harriman lines.

This electrification is perhaps the most difficult and important installation which has so far been seriously considered. The New York Central and the New Haven electrifications are simple problems compared to it. The New York Central was compelled by law to abandon steam locomotives in the Park avenue tunnel, and it planned its electric equipment, not so much with the idea of immediate economy in operation, as with the belief in great expansion of business in the future in a thickly populated territory which could be handled more profitably and with greater comfort to passengers by electric trains than with steam trains. The New Haven went even farther and designed its installation with the idea of immediate economy of operation and the ultimate extension of electricity over the greater part of its network of lines in Connecticut.

The economy of electric operation is still open to some discussion. The possibility of increasing the carrying capacity of a given piece of track by substituting electricity for steam as motive power is perhaps more easily proved, yet heretofore this has been a consideration of secondary importance. In the Southern Pacific's problem it is the first important consideration; reasonable economy must, of course, be attained, but it would be worth while to increase the cost of operation slightly if it was found possible to increase the capacity of the line one-half or more. Any of the plans proposed will cost enormous sums to carry out, and the committee will have to decide which method will best meet present and future needs for the least ultimate cost.

The Sacramento division crosses the Sierra Nevada mountains at an elevation of 7,018 ft. It is the most direct route to San Francisco, and all the through traffic of the Union Pacific which is not diverted north over the Oregon Short Line to Portland or south over the San Pedro, Los Angeles & Salt Lake to Los Angeles must be carried up the steep slopes on one side and down the equally steep slopes on the other side. The traffic is heavy, but quite irregular and blockades are frequent in the yards at both ends of the division. The road is single track with few sidings, and because of the difficult location it is practically impossible to double-track it throughout or to greatly increase the length of the sidings. The road is full of sharp curves, and between Rocklin and Sparks there are more than 31 miles of tunnels and snow sheds. Rocklin, at the foot of the eastbound grate, has an elevation of 250 ft. and from that point to the summit, 83 miles, there is a total rise of 6,768 ft., an average of 81½ ft. per mile, with a maximum of 116 ft. per mile. Westbound the maximum grade begins at Truckee, and the rise to the summit, 14 miles, is 1,198 ft., an average of 85½ ft., with a maximum of 105 ft. per mile. In the winter the snow often accumulates to a depth of from 15 to 20 ft. in the exposed places.

Various methods have been proposed and carefully looked into for relieving in part the congestion of this very much overworked line. An entirely new single-track line has been located some distance away which has slightly more favorable grades, and if built would be equivalent to providing a second track on the present location. Tunneling the Sierras at a lower elevation and thus reducing the length, as well as the steepness of the grades on each side, has also been proposed.

Mr. Babcock has been studying the possibilities of a change in motive power from steam to electricity for nearly three years and has collected much of the necessary data on which a report can be based. It is by no means assured, however, that the company will decide to adopt electricity instead of the difficult construction work for a new line or the daring scheme of a long tunnel under the mountains, for the difficulties of installing and maintaining the necessary electrical equipment may be found to be too great. The principal advantage of electricity as a motive power would be that it could be installed in much less time than a new line could be built, and the results would be noticeable from the beginning of operation of the first section. In case a tunnel was built it would be necessary in any event to use electricity as a motive power.

Some of the difficulties to be overcome if electric operation of the entire division is finally decided upon are: Installation and maintenance of transmission lines to withstand heavy snows and violent storms without interruption. Provision for wide variations in load

with heavy but very intermittent traffic. Danger from fire in snow sheds during the summer and from short circuits due to melting snow in the spring. Extreme cost of substantial and permanent overhead line construction and danger to trainmen in tunnels and snow sheds if this method should be employed. Interference by snow in the open if third rail construction is used.

The two engineers who will report on this problem have not as yet decided on any of the details of the apparatus which might be employed. They are approaching the subject with open minds, and it is possible that after a thorough consideration of the problem they may report to the committee that the scheme is not practical. In any event, their report, when made, will be an interesting study of the possibilities of electric operation along lines which are beginning to attract serious attention.

RAIL SECTIONS AND SPECIFICATIONS

The Progress Report of the Special Committee on Rail Sections of the American Society of Civil Engineers, embodying the "Recommended Specifications for Bessemer Steel Rails" is given in full herewith. As stated by the committee "in the designing of heavier sections, particular attention is being given to the advisability of increasing the percentage of metal in the webs and flanges, as compared with the existing sections recommended by your society." This proposed change would probably prove a decided step in the right direction, in that it would not only increase the strength and stiffness of the rail, but would allow of a much lower finishing temperature in rolling than is possible with the present thin flanges.

For convenience of comparison and discussion these recommended specifications are printed below in parallel columns with those adopted by the American Railway Engineering and Maintenance of Way Association and those passed to letter ballot by the American Society for Testing Materials at its recent annual meeting. A discussion of the report made to the American Society of Civil Engineers by the special committee has been made an order of business for the annual meeting to be held in January next, and a committee of the American Railway Association is also engaged in the study of the problem of rail sections and rail specifications. The time seems opportune, therefore, to call attention to some of the differences in the above specifications.

It is believed that a specification embodying the best features of the three specifications here cited with adequate provision for tests would insure a safe rail of good wearing properties. It may be safely asserted that the unsatisfactory experience within recent years with rails under modern service conditions have been due mainly to the fact that the specifications under which such rails have been furnished were not sufficiently rigid, and that the mills have been disinclined to accept orders under specifications designed to insure a better and more uniform material. It is certain, however, that no matter how exacting the specifications may be made in the letter, the standard of excellence that they are designed to secure cannot be insured without more rigid inspection than has been customary in the past.

The three specifications referred to are as follows: (For convenience of comparison the sequence of the paragraphs has been slightly modified to adapt them to the specifications recommended by the special committee of the American Society of Civil Engineers.)

AMERICAN SOCIETY OF CIVIL ENGINEERS.

"Recommended Specifications for Bessemer Steel Rails.*

"*Process of Manufacture.*—The entire process of manufacture and testing shall be in accordance with the best state of the art, and the following instructions shall be faithfully executed:

"Ingots shall be kept in a vertical position in the pit heating furnaces until ready to be rolled, or until the metal in the interior has had time to solidify.

"No bled ingots shall be used.

"There shall be sheared from the end of the blooms formed from the top of the ingots not less than twenty-five per cent., and if, from any cause, the steel does not then appear to be solid, the shearing shall continue until it does. If, by the use of any improvements in the process of making ingots, the defect known as piping shall be prevented, the above shearing requirements may be modified.

"The number of passes and speed of train shall be so regulated that on leaving the rolls at the final pass, the temperature of the rail will not exceed that which requires a shrinkage allowance at the hot saws, for a 33-ft. rail of 100-lb. section, of 6 7-16 in.. and 1-16 in. less for each 5-lb. decrease of section. These allowances to be decreased at the rate of 1-90 in. for each second of time elapsed between the rail leaving the finishing rolls and being sawn. No artificial means of cooling the steel shall be used after the rails leave the rolls, nor shall they be held before sawing for the purpose of reducing their temperature."

"*Chemical Composition.*—Rails of the various weights per yard specified below shall conform to the following limits in chemical composition:

	70-79lb. Percentage.	80-89lb. Percentage.	90-100lb. Percentage.
Carbon	0.50-0.60	0.53-0.63	0.55-0.65
Phosphorus shall not exceed	0.085	0.085	0.085
Silicon shall not exceed	0.20	0.20	0.20
Sulphur shall not exceed	0.075	0.075	0.075
Manganese	0.75-1.00	0.80-1.05	0.80-1.05

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION.

SPECIFICATIONS FOR BESSEMER STEEL RAILS.

STANDARD SPECIFICATIONS.

(1) (a) The entire process of manufacture and testing shall be in accordance with the best current practice, and special care shall be taken to conform to the following instructions:

(b) Ingots shall be kept in a vertical position in the pit heating furnaces until ready to be rolled, or until the metal in the interior has time to solidify.

(c) No bled ingots shall be used.

(d) There shall be sheared from the end of the blooms formed from the top of the ingots not less than twenty-five (25) per cent., and if, from any cause, the steel does not then appear to be solid, the shearing shall continue until it does. If, by the use of any improvements in the process of making ingots, the defect known as piping shall be prevented, the above shearing requirements may be modified.

(2) Rails of the various weights per yard specified below shall conform to the following limits in chemical composition:

(5) The number of passes and speed of train shall be so regulated that on leaving the rolls at the final pass, the temperature of the rail will not exceed that which requires a shrinkage allowance at the hot saws for a 33-ft. rail of 100-lb. section of 6 7-16 in., and 1-16-in. less for each 5-lb. decrease of section, these allowances to be decreased at the rate of 1-90-in. for each second of time elapsed between the rail leaving the finishing rolls and being sawn. No artificial means of cooling the steel shall be used after the rails leave the rolls, nor shall they be held before sawing for the purpose of reducing their temperature.

	Percentage		
	70-79 lbs.	80-89 lbs.	90-100 lbs.
*Carbon	0.50-0.60	0.53-0.63	0.55-0.65
Phosphorus shall not exceed	0.085	0.085	0.085
Silicon shall not exceed	0.20	0.20	0.20
Sulphur shall not exceed	0.075	0.075	0.075
Manganese	0.75-1.00	0.80-1.05	0.80-1.05

*Carbon may be reduced to suit local conditions.

AMERICAN SOCIETY FOR TESTING MATERIALS.

PROPOSED STANDARD SPECIFICATIONS.

1. (a) The entire process of manufacture and testing shall be in accordance with the best current practice, and special care shall be taken to conform to the following instructions: (b) Ingots shall be kept in a vertical position in the pit heating furnaces until ready to be rolled or until the metal in the interior has time to solidify. (c) No bled ingots shall be used. (d) There shall be sheared from the end of the blooms formed from the top of the ingots not less than x %,† and if, from any cause, the steel does not then appear to be solid, the shearing shall continue until it does.

†The percentage of minimum discard in any case to be subject to agreement and it should be recognized that the higher this percentage the greater will be the cost.

4. The number of passes and speed of train shall be so regulated that on leaving the rolls at the final pass the temperature of the rail will not exceed that which requires a shrinkage allowance at the hot saws, for a 30-foot rail of 100-pound section of 6 11-16 inches, and 1-16 inch less for each 5-pound decrease of section. These allowances to be decreased at the rate of 0.01 inch for each second of time elapsed between the rail leaving the finishing rolls and being sawed. No artificial means of cooling the rails shall be used between the finishing pass and the hot saws.

2. Rails of the various weights per yard specified below shall conform to the following limits in chemical composition:

	Carbon.	Phosphorus, shall not exceed.	Silicon, shall not exceed.	Manganese.
50-59 lbs., per cent.	0.35-0.45	0.10	0.20	0.70-1.00
60-69 lbs., per cent.	0.38-0.48	0.10	0.20	0.70-1.00
70-79 lbs., per cent.	0.40-0.50	0.10	0.20	0.75-1.05
80-89 lbs., per cent.	0.43-0.53	0.10	0.20	0.80-1.10
90-100 lbs., per cent.	0.45-0.55	0.10	0.20	0.80-1.10

*Progress report of the Special Committee on Rail Sections; A. S. C. E.: "*Gentlemen*:—Your committee respectfully report that they have given the report, which they submitted under date of Jan. 17, 1906, and which was referred back to them, careful consideration, and would now report that they are in consultation with committees representing other societies and organizations, as well as other interested parties, on the subject of modified rail sections, with the purpose of preparing and submitting to your society a new series of such sections. In this designing of heavier sections, particular attention is being given to the advisability of increasing the percentage of metal in the webs and flanges as compared with the existing sections recommended by your Society. This they hope to accomplish in due time, and in the meantime respectfully submit to the society for its consideration the following specifications for the manufacture of Bessemer and open-hearth rails:

A. S. C. E.

"*Drop Test.*—One drop test shall be made on a piece of rail, not less than 4 ft. and not more than 6 ft. long, selected from each blow of steel. The test piece shall be taken from the top of the ingot. The rails shall be placed head upward on the supports, and the various sections shall be subjected to the following impact tests under a free falling weight:

70 to 79-lb. rails	18 ft.
80 to 89-lb. rails	20 ft.
90 to 100-lb. rails	22 ft.

"If any rail breaks, when subjected to the drop test, two additional tests may be made of other rails from the same blow of steel, also taken from the top of the ingots, and if either of these latter rails fail, all the rails of the blow which they represent will be rejected, but if both of these additional test pieces meet the requirements, all the rails of the blow which they represent will be accepted.

"The drop-testing machine shall have a tup of 2,000 lb. weight, the striking face of which shall have a radius of not more than 5 in., and the test rail shall be placed head upward on solid supports 3 ft. apart. The anvil block shall weigh at least 20,000 lb., and the supports shall be part of, or firmly secured to, the anvil. The report of the drop test shall state the atmospheric temperature at the time the test was made."

"*Section.*—The section of rail shall conform, as accurately as possible, to the templet furnished by the railroad company, consistent with the paragraph relative to specified weight. A variation in height of 1-64 in. less, or 1-32 in. greater than the specified height, and 1-16 in. in width will be permitted. The section of rail shall conform to the finishing dimensions.

"*Weight.*—The weight of the rails will be maintained as nearly as possible, after complying with the preceding paragraph, to that specified in contract. A variation of one-half of 1 per cent. for an entire order will be allowed. Rails will be accepted and paid for according to actual weights.

"*Length.*—The standard length of rails shall be 33 ft. Ten per cent. of the entire order will be accepted in shorter lengths varying by even feet to 27 ft., and all No. 1 rails less than 33 ft. long shall be painted green on the ends. A variation of ¼ in. in length from that specified will be allowed.

"*Drilling.*—Circular holes for splice bars shall be drilled in accordance with the specifications of the purchaser. The holes shall conform accurately to the drawing and dimensions furnished, in every respect, and must be free from burrs.

"*Straightening.*—Care must be taken in hot-straightening the rails, and it must result in their being left in such condition that they shall not vary throughout their entire length more than 5 in. from a straight line in any direction, when delivered to the cold-straightening presses. Those which vary beyond that amount, or have short kinks, shall be classed as second-quality rails and be so stamped.

"Rails shall be straight in line and surface when finished—the straightening being done while cold—smooth on head, sawed square at ends, variation to be not more than $^1/_{32}$ in., and, prior to shipment shall have the burr occasioned by the saw cutting removed, and the ends made clean. No. 1 rails shall be free from injurious defects and flaws of all kinds.

"No. 2 rails shall be accepted up to 5 per cent. of the whole order. They shall not have flaws in their heads of more than ¼ in., or in the flange of more than ½ in. in depth, and, in the judgment of the inspector, these shall not be so numerous or of such a character as to render them unfit for recognized second-quality rail uses. The ends of No. 2 rails shall be painted white, and shall have two prick-punch marks on the side of the web near the heat number brand, and placed so as not to be covered by the splice bars. Rails from heats which failed under the drop-test shall not be accepted as No. 2 rails.

M. of W.

(3) One drop test shall be made on a piece of rail not less than 4 ft. and not more than 6 ft. long, selected from each blow of steel. The test piece shall be taken from the top of the ingot. The rails shall be placed head upward on the supports, and the various sections shall be subjected to the following impact tests under a free falling weight:

70 to 79-lb. rails	18 ft.
80 to 89-lb. rails	20 ft.
90 to 100-lb. rails	22 ft.

If any rail breaks when subjected to the drop test, two additional tests may be made of other rails from the same blow of steel, also taken from the top of the ingots, and if either of these latter rails fail, all the rails of the blow which they represent will be rejected, but if both of these additional test pieces meet the requirements, all the rails of the blow which they represent will be accepted.

(4) The drop-testing machine shall have a tup of 2,000 lbs. weight, the striking face of which shall have a radius of not more than 5 in., and the test rail shall be placed head upward on solid supports 3 ft. apart. The anvil block shall weigh at least 20,000 lbs., and the supports shall be part of, or firmly secured to, the anvil. The report of the drop test shall state the atmospheric temperature at the time the test was made.

(7) Unless otherwise specified, the section of rail shall be the American Standard, recommended by the American Society of Civil Engineers, and shall conform, as accurately as possible, to the templet furnished by the railroad company, consistent with paragraph No. 8, relative to specified weight. A variation in height of one sixty-fourth (1-64) inch less, or one thirty-second (1-32) inch greater than the specified height, and one-sixteenth (1-16) inch in width, will be permitted. The section of rail shall conform perfectly to the finishing dimension.

(8) The weight of the rails will be maintained as nearly as possible, after complying with paragraph No. 7, to that specified in contract. A variation of one-half (½) of one per cent. for an entire order will be allowed. Rails shall be accepted and paid for according to actual weights.

(9) The standard length of rails shall be 33 ft. Ten per cent. of the entire order will be accepted in shorter lengths, varying by even feet to 27 ft., and all No. 1 rails less than 33 ft. shall be painted green on the end. A variation of one-fourth of an inch in length from that specified will be allowed.

(10) Circular holes for splice bars shall be drilled in accordance with the specifications of the purchaser. The holes shall accurately conform to the drawings and dimensions furnished in every respect, and must be free from burrs.

(11) Rails shall be straight in line and surface when finished—the straightening being done while cold—smooth on head, sawed square at ends, variation to be not more than $^1/_{32}$ in., and, prior to shipment shall have the burr occasioned by the saw cutting removed and the ends made clean. No. 1 rails shall be free from injurious defects and flaws of all kinds.

(12) Care must be taken in hot-straightening the rails, and it must result in their being left in such a condition that they shall not vary throughout their entire length of 33 ft. more than 3 in. from a straight line in any direction, when delivered to the cold straightening presses. Those which vary beyond that amount, or have short kinks, shall be classed as second quality rails and be so stamped. The distance between supports of rails in the gagging press shall not be less than 42 in.

(15) No. 2 rails will be accepted up to five (5) per cent. of the whole order. Rails that possess any injurious defects, or which for any other cause are not suitable for first quality, or No. 1 rails, shall be considered as No. 2 rails; provided, however, that rails which contain any physical defects which impair their strength shall be rejected. The ends of all No. 2 rails shall be painted white in order to distinguish them. Rails rejected under the drop test will not be accepted as No. 2 rails.

A. S. T. M.

3. One drop test shall be made on a piece of rail not less than four feet and not more than six feet long, selected from every fifth blow of steel. The test shall be taken from the top of the ingot. The rail shall be placed head upwards on the supports, and the various sections shall be subjected to the following impact tests under a free falling weight:

Weight of rail, pounds per yard.			Height of drop, feet.
45	to and including	55	15
More than .. 55	to and including	65	16
More than .. 65	to and including	75	17
More than .. 75	to and including	85	18
More than .. 85	to and including	100	19

If any rail breaks when subjected to the drop test, two additional tests, taken from the top of the ingot, will be made of other rails from the same blow of steel, and if either of these latter tests fails, all the rails of the blow which they represent will be rejected, but if both of these additional test pieces meet the requirements, all the rails of the blow which they represent will be accepted.

5. The drop testing machine shall have a tup of 2,000 pounds weight, the striking face of which shall have a radius of not more than five inches, and the test rail shall be placed head upwards on solid supports three feet apart. The anvil block shall weigh at least 20,000 pounds, and the supports shall be part of, or firmly secured to, the anvil. The report of the drop test shall state the atmospheric temperature at the time the test was made.

7. Unless otherwise specified, the section of rail shall be the American standard, recommended by the American Society of Civil Engineers, and shall conform, as accurately as possible, to the templet furnished by the railroad company, consistent with Paragraph No. 8, relative to specified weight. A variation in height of 1-64 of an inch less, or 1-32 of an inch greater than the specified height, and 1-16 in. in width will be permitted.

8. The weight of the rails will be maintained as nearly as possible, after complying with Paragraph No. 7, to that specified in contract. A variation of one-half of 1 per cent. for an entire order will be allowed. Rails shall be accepted and paid for according to actual weights.

9. The standard length of rails shall be 30 ft. Ten per cent. of the entire order will be accepted in shorter lengths, varying by even feet to 24 ft., and all No. 1 rails less than 30 ft. shall be painted green on the end. A variation of one-fourth of an inch in length from that specified will be allowed.

10. Circular holes for splice bars shall be drilled in accordance with the specifications of the purchaser. The holes shall accurately conform to the drawing and dimensions furnished in every respect, and must be free from burrs.

11. Care must be taken in hot-straightening the rails, and it must result in their being left in such a condition that they shall not vary throughout their entire length more than 5 in. from a straight line in any direction when delivered to the cold-straightening presses. Those which vary beyond that amount, or have short kinks, shall be classed as second quality rails and be so stamped. The distance between supports of rails in the gagging press shall be not less than 42 in. Rails shall be straight in line and surface when finished—the straightening being done while cold—smooth on head, sawed square at ends, variations to be not more than $^1/_{32}$ in., and, prior to shipment, shall have the burr occasioned by the saw cutting removed, and the ends made clean. No. 1 rails shall be free from injurious defects and flaws of all kinds.

14. No. 2 rails will be accepted up to 10 per cent. of the whole order. Rails which possess any injurious defects, or which for any other cause are not suitable for first quality, or No. 1 rails, shall be considered as No. 2 rails; provided, however, that rails which contain any physical defects which impair their strength shall be rejected. The ends of all No. 2 rails shall be painted white in order to distinguish them.

A. S. C. E.

"Branding.—The name of the maker, the weight of the rail, and the month and year of manufacture, shall be rolled in raised letters on the side of the web; and the number of the blow shall be plainly stamped on each rail where it will not subsequently be covered by the splice bars.

"Inspection.—The inspector representing the purchaser shall have free entry to the works of the manufacturer, at all times when the contract is being filled, and shall have all reasonable facilities afforded him by the manufacturer to satisfy him that the finished material is furnished in accordance with the terms of these specifications. All tests and inspection shall be made at the place of manufacture prior to shipment.

"The manufacturer shall furnish the inspector, daily, with carbon determinations for each blow and a complete chemical analysis every 24 hours, representing the average of the other elements contained in the steel, for each day and night turn. These analyses shall be made on drillings taken from small test ingots. On the request of the inspector, the manufacturer shall furnish drillings for check analyses.

"For Basic Open-Hearth Rails.—The specifications for rails made by the Basic Open-Hearth process shall be the same as for Bessemer rails, excepting that a full chemical determination shall be furnished for each heat and two drop-tests from each. Their chemical composition shall be:

	Per cent.		
	70 to 79 lbs.	80 to 89 lbs.	90 to 100 lbs.
Carbon	0.53 to 0.63	0.58 to 0.68	0.65 to 0.75
Phosphorus*	0.05	0.05	0.05
Silicon*	0.20	0.20	0.20
Sulphur*	0.06	0.06	0.06
Manganese	0.75 to 1.00	0.80 to 1.05	0.80 to 1.05

*Shall not exceed.

M. of W.

(13) The name of the maker, the weight of rail and the month and year of manufacture shall be rolled in raised letters on the side of the web, and the number of blow shall be plainly stamped on each rail where it will not subsequently be covered by the splice bars.

(14.) The inspector representing the purchaser shall have free entry to the works of the manufacturer at all times when the contract is being filled and shall have all reasonable facilities afforded him by the manufacturer to satisfy him that the finished material is furnished in accordance with the terms of these specifications. All tests and inspection shall be made at the place of manufacture prior to shipment.

(6) The manufacturer shall furnish the inspector daily with carbon determinations for each blow, and a complete chemical analysis every 24 hours, representing the average of the other elements contained in the steel, for each day and night turn. These analyses shall be made on drillings taken from small test ingots.

"For Basic Open-Hearth Rails.—The specifications for rails made by the basic open-hearth process shall be the same as for Bessemer rails, excepting that their chemical composition shall be:

	Per cent.		
	70 to 79 lbs.	80 to 89 lbs.	90 to 100 lbs.
Carbon	0.63 to 0.73	0.68 to 0.78	0.75 to 0.85
Phosphorus*	0.03	0.03	0.03
Silicon	.075 to 0.20	.075 to 0.20	.075 to 0.20
Sulphur*	0.06	0.06	0.06
Manganese*	0.90	0.90	0.90

*Shall not exceed.

A. S. T. M.

12. The name of the maker, the weight of rail and the month and year of manufacture shall be rolled in raised letters on the side of the web, and the number of blow shall be plainly stamped on each rail where it will not subsequently be covered by the splice bars.

13. The inspector representing the purchaser shall have free entry to the works of the manufacturer at all times when the contract is being filled and shall have all reasonable facilities afforded him by the manufacturer to satisfy him that the finished material is furnished in accordance with the terms of these specifications. All tests and inspections shall be made at the place of manufacture prior to shipment.

6. The manufacturer shall furnish the inspector, daily, with carbon determinations for each blow, and a complete chemical analysis every 24 hours, representing the average of the other elements contained in the steel, for each day and night turn. These analyses shall be made on drillings taken from a small test ingot.

The more important points of difference between the above specifications will now be briefly considered:

Process of Manufacture.—The American Society of Civil Engineers and Maintenance of Way specifications provide for a discard of 25 per cent. from the end of the blooms formed from the top of the ingots, and it is added that "if, by the use of any improvements in the process of making ingots, the defect known as piping shall be prevented, the above shearing requirements may be modified," whereas the American Society for Testing Materials specifications leave the percentage of minimum discard blank with the provision that "the percentage of minimum discard in any case is to be subject to agreement, and it should be recognized that the higher this percentage the greater will be the cost."

It is frequently claimed by the manufacturers that a minimum discard of 25 per cent. is excessive, and that many of the failures of rails in service which are ascribed to piping are really due to other causes. Nevertheless, it can hardly be denied that piped steel is responsible for many cases of rail failure which might have been avoided by a more liberal discard. This important problem of piping would seem to be one deserving of the most careful investigation through the co-operation of all parties in interest with a view of determining by what means and to what extent it may be controlled. If, for example, it should appear that by the use of steel of certain chemical composition, cast at a lower temperature than is now customary, the piping can be reduced the specific percentage of minimum discard may then be modified accordingly. There can be no question that the safety of the rail should be the first consideration, irrespective of incidental increased cost, and that until the amount of piping can be more definitely controlled it is preferable that the discard be somewhat excessive rather than too low.

The claim that with large discard the accumulation of bloom ends cannot be advantageously utilized should not be regarded as valid so long as such heavy discards are really necessary to insure solid metal. Moreover, the bloom ends may frequently be used, at least in part, for rolling light rails, as has been done in the past at certain mills. Such materials under proper restrictions might also be utilized for heavy rails of second grade to be put in sidings.

In each of these specifications the importance of securing a sufficiently low finishing temperature in rolling is recognized, and it is aimed to secure the same by specifying the maximum allowable amount of shrinkage for rails of different weights. This provision is undoubtedly in the right direction, but the conditions are complicated by the fact that the present rail sections do not lend themselves readily to low finishing temperatures by reason of insufficient metal in the web and flange, as compared with the head. With the proposed increased thickness of metal in web and flange the requirements in this particular can be much more satisfactorily met.

In this connection attention may be called also to the trouble caused by too heavy reductions in the early passes in the blooming mill, tending to tear the metal. Such defects, although they may apparently disappear during subsequent rolling to the extent of escaping surface inspection, may become sources of weakness in service and direct causes of failure.

The tendency on the part of the mills to use an insufficient number of passes in rolling in the rail mill is also calculated to have a detrimental effect on the product, and it is believed that mill practice in this respect might be modified to good advantage.

The percentage of second quality rails to be accepted, which is fixed at 5 per cent. by the American Society of Civil Engineers and Maintenance of Way specifications and at 10 per cent. by the American Society for Testing Materials specifications, also influences the quality of the product indirectly to an important degree. The lower this percentage the greater becomes the incentive to the manufacturer to exercise care at every stage of manufacture to avoid the accumulation of rejected rails, which under a larger percentage would be accepted as second quality.

In each of these specifications the importance of allowing sufficient time for the ingots to properly solidify is provided for in a general way, but in practice it is difficult to insure strict compliance with this provision.

Referring to the above features collectively, it is believed that an earnest effort on the part of the mills to secure improved conditions of manufacture in the directions indicated, together with the adoption of a heavier and better balanced rail section, would obviate the present difficulties to a large extent.

Chemical Composition.—The American Society of Civil Engineers and Maintenance of Way specifications prescribe that the phosphorus shall not exceed 0.085, with a range in carbon of 0.55 to 0.65 for the heaviest sections, whereas the American Society for Testing Materials specifications fix the phosphorus limit at 0.10 and the carbon limits at 0.45 to 0.55. The maintenance of way specifications provide, however, that the carbon limits "may be reduced to suit local conditions."

It is generally admitted that a higher percentage of phosphorus tends to increase brittleness, especially with higher carbon content. The supply of low phosphorus ores is, however, said to be insufficient to permit of the general adoption of the 0.085 percentage of phosphorus. If the validity of this claim be admitted there is apparently no good reason for not rolling such rails to the extent

to which low phosphorus ores are available for use in situations in which quality is of first importance. It is likely that the conditions in this respect will also be improved by the use of rails made of open hearth steel.

While it is conceded that good rails have been made in the past with a phosphorus content not exceeding 0.10, this limit is believed to be too high for rails of the present weight and section under the conditions of manufacture usually prevalent and for the present heavy service conditions. If the section be suitably increased with the added metal distributed between the web and flange it is possible that with proper care at every stage of manufacture a percentage of phosphorus not exceeding 0.10 for Bessemer steel rails will be found admissible.

Drop Tests.—The American Society of Civil Engineers and Maintenance of Way specifications call for one drop test from each blow of steel with 22 ft. height of fall on 90 to 100 lb. rails, whereas the American Society for Testing Materials specifications require one drop test from every fifth blow and a 19-ft. fall on a 85 to 100 lb. rail. It is important to note that each specification requires the test piece to be taken from that portion of the rail representing the top of the ingot.

The provision in the American Society of Civil Engineers and Maintenance of Way specifications, by which one test is required from every heat of steel and higher drop tests are called for than in the American Society for Testing Materials specifications, seem reasonable and preferable, especially since the present average quality of rails has proven unsatisfactory, and it is therefore desirable that the requirements should be raised rather than lowered.

Length of Rail.—The American Society for Testing Materials specifications require a standard length of 30 ft., as against 33 ft. adopted in the other two specifications. The only justification for adherence to a 30-ft. length is believed to be the shortage in cars of suitable length for hauling the longer rails, but since this difficulty is rapidly disappearing it may doubtless be assumed that the 33-ft. length will soon be adopted as a general standard.

Straightening.—All of the specifications recognize the importance of having the rails as straight as possible when they come from the cooling beds and two of the specifications limit the distance apart between the supports of the rails in the gagging press to not less than 42 in. This is one of the most important clauses in the specifications, as serious injury may be done to the rail in gagging, and any improvement that can be made either in section of rail or in rolling to avoid this severe treatment would be an important gain. The omission of any reference to the distance between supports of rails in the gagging press in the American Society of Civil Engineers specifications is believed to be undesirable. On the other hand the restriction of the camber to 3 in. in these, as well as the maintenance of way specifications, is doubtless preferable to the 5-in. limit prescribed by the American Society for Testing Materials specifications, and it is believed that the lower limit does not impose undue hardship on the mills.

No. 2 Rails.—The bearing of the allowable percentage of second quality rails to be accepted on the question of manufacture has already been referred to above under "process of manufacture." Aside from this it is believed, however, that the provisions governing the classification of No. 2 rails in all of these specifications are too lenient, and that rails embodying certain of the defects stated should be rejected absolutely as unfit for use.

Basic Open Hearth Steel Rails.—The American Society for Testing Materials specifications contain no reference to basic open hearth rails. The American Society of Civil Engineers specifications prescribe a limit of 0.05 for phosphorus and a carbon range of 0.65 to 0.75 for 90-100-lb. rails, as against a limit of 0.03 for phosphorus and 0.75 to 0.85 for carbon in the Maintenance of Way specifications, the aim of the latter being doubtless to secure a rail of equal wearing properties and decreased brittleness. The latter specifications are believed to be preferable, and it is to be hoped that the small range of ten points in carbon can be met by the manufacturers of basic open hearth steel, since it is a well-established fact that the carbon content cannot be controlled in this process as readily as in the case of the high carbon steels manufactured by either the acid open hearth or Bessemer processes.

It will be noted that the maintenance of way specifications contain the same provisions for drop tests for basic open hearth steel as for Bessemer steel, whereas the American Society of Civil Engineers specifications call for two drop tests from each heat of open hearth steel and a full chemical determination for the same. Both of these provisions are believed to be desirable to insure uniformity of product in the case of open hearth steel.

In conclusion it may be said that in the use of the open hearth process the desirability of a change of section, as well as the exercise of due precaution at every stage of manufacture, including the important question of finishing temperature, is just as great as in the case of the Bessemer process, although possibly experience will show that an increased weight of section will be unnecessary for open hearth rails. The *Railroad Gazette* will welcome discussion of this subject in its columns, not only from the committee members to whom the subject has been entrusted, but also from railroad officers who may differ from any of the conclusions expressed above.

The *Electric Traction Weekly*, quoting what we said concerning the recent disastrous collision at Salem, Michigan, and particularly that "the only way to cure the faults in the despatching system is to abolish the system and use in its place the block system," says:

"This would be most encouraging if, unfortunately, roads equipped with block systems did not have as many collisions as roads where the block has not been installed. How can the uncertain human factor be eliminated from train movements? How, for instance, after the most perfect system that human genius can devise has been put in force, can you make sure that the operator will make his dots large enough between the station name and the schedule figures?"

The implication that collisions are as frequent under the block system as on roads not thus worked, must be based on data from trolley roads which use various electrical arrangements that are not block signals in the true sense of the term. Where has our contemporary found any statistics really comparable, to justify the statement made? The best way to "eliminate the uncertain human factor" is to adopt the electrical and mechanical safeguards of the true block system. With that, the question how to make sure of an operator's dots no longer troubles.

The action of the Master Car Builders' Association, in providing a virtual penalty for putting paper and cloth advertisements on freight cars, is now taking effect. The Pennsylvania Railroad has given instructions to agents to see that shippers do not violate the rule and, in any event, to see that cars do not go forward with advertisements posted on them. Other roads have taken similar action. If any one misses the mental stimulus of these varied advertisements, he still can gaze, any day, at any station, on some big, yellow refrigerator car, bearing on its side in vivid and artistic (?) lettering the advertisement of the firm owning the car.

The increase in the express business which has been so widespread in the territory east of the Missouri river during the past few years, leading to the establishment, both for through and way business, of separate trains for the carriage of parcels, appears to be confined to no particular section of the country. The Southern Pacific has decided to run one train each way daily throughout its principal lines for the accommodation of the express company's business, namely, from San Francisco to Ogden, Utah; to Portland, Ore., and to El Paso, Tex. Some of these trains will incidentally carry a limited number of local passengers, but their main business will be to carry the express company's traffic. The through passenger trains will of course by this relief be enabled to shorten their stops and thus more surely maintain their schedule time. The aggregate length of these three routes is 2,844 miles.

Central of Georgia.

The 1907 year of the Central of Georgia is especially interesting for two primary reasons; first, because the $5,000,000 capital stock of the company which has been held by the reorganization committee of the Richmond Terminal Company since 1896 was sold during the year to Oakleigh Thorne and Marsden J. Perry, and, second, because of the company's inability on the face of published earnings to pay the full dividend on the second series of income bonds or any dividend at all on the third series, and the contest instituted by a committee representing income bond holders, who maintained that the equity of the earnings of the Ocean Steamship Company of Savannah should be used to provide for the return on the income bonds of the railroad company.

It will be recalled that in 1895 the company succeeded to the foreclosed property of the Central Railroad & Banking Company of Georgia. The capital stock of the company has remained unchanged at $5,000,000, which is at the rate of only about $3,348 a mile, and ownership of this stock has never been advertised, except that President Spencer, of the Southern Railway Company, stated in his testimony in 1899 that the Southern was entitled to the financial benefit of any sale of the stock, though it did not assume to control the railroad. The operation of the property may, therefore, be described as having been on a semi-independent basis, friendly to the Southern Railway.

Last June, Adrian H. Joline, Chairman of the Richmond Terminal reorganization committee, announced that the committee had sold to Mr. Thorne and Mr. Perry all the stock of the Central of Georgia, the net proceeds of which were to be paid to the Southern

Railway, while the new owners declared their purpose to operate and develop the system independently for the benefit of the shareholders, and announced that they would hold at least 60 per cent. of the stock for at least two years.

On August 14 a meeting took place in New York of the owners of the property and of representatives of the larger bond holders to formulate a plan for the retirement of the income bonds, the face value of which is $15,000,000, about one-fifth of which is held in Savannah, Ga., and perhaps one-third in New York. It is understood that the plan proposed was that the 5 per cent. income bonds should be exchanged for an equal amount of 4 per cent. bonds with interest as a part of the fixed charges, but there was a disagreement, as has been mentioned above, as to the payment of the interest on these bonds through the medium of a dividend which the Central of Georgia presumably could receive if it chose to do so from its subsidiary company, the Ocean Steamship Company of Savannah, which operates a fleet of 10 excellent steamships (including a new one not quite completed) between New York and Savannah and Boston and Savannah.

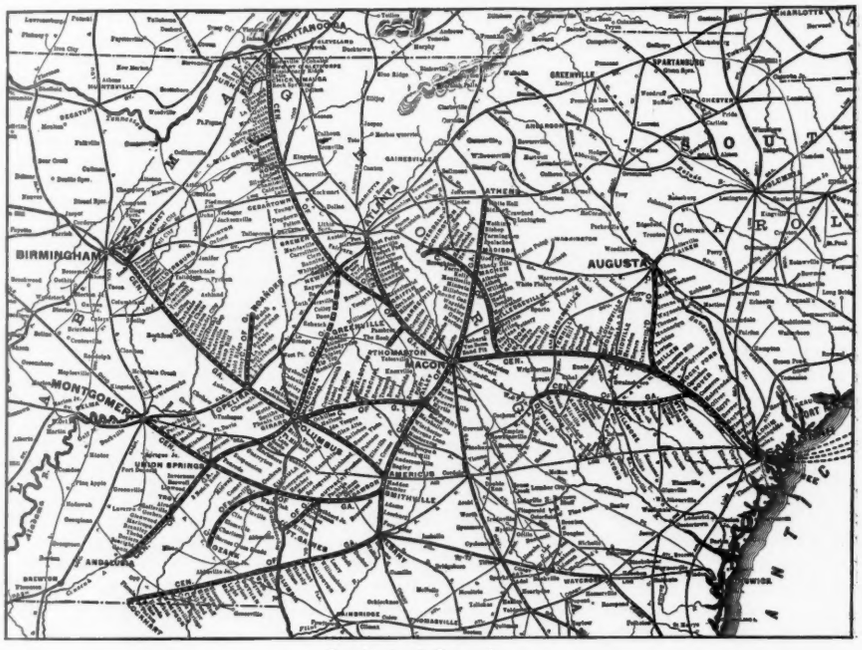
Details of the capitalization of the Ocean Steamship Company are not to be found in the railroad company's report, but the rail company guarantees $1,579,000 bonds for the water company and owns its entire capital stock of $2,000,000, of which $1,995,000 is pledged as security for the collateral trust bonds, and also owns the entire capital stock of the New England & Savannah Steamship Company, practically the entire issue of which is pledged as security for the consolidated mortgage bonds. These two companies may to all intents and purposes be considered as a single going concern, operated with the same ships and financed with the same capital. No dividends are paid on the marine stock, but the value of the 10 sea-going vessels could not be appraised at less than $3,000,000, and their earnings should certainly be large in view of the fact that they are continuously fed with traffic by a railroad company and perform an active and doubtless a profitable service, the six newer vessels being particularly well designed to carry a maximum amount of freight on a minimum coal consumption. The attitude taken by the railroad company is that the equity in the earning of the marine properties belongs not to the income bonds but to the stock of the company. It is not our province to pass judgment upon this contention, but merely to indicate the interesting and unusual facts, which furnish an exceedingly clear illustration of the principle of a subsidiary concern with concealed earnings, since it must be assumed that a considerable portion of the cost of the marine fleet has been paid for out of its own earnings, as was done in years past with such marked success and profit by the White Star Line of transatlantic steamships.

Gross earnings of the railroad company in 1907 were $12,082,777, as compared with $11,396,123 in 1906; an increase of $686,655, but operating expenses and taxes increased $1,371,004 in the same period and charges increased $155,514, with the net result that the balance available for interest on the income bonds was $448,126, as against $1,250,671 in 1906. Out of this sum, $12,937 was credited direct to profit and loss; 5 per cent. interest was reserved for the $4,000,000 first preference income bonds; 3.729 per cent. was reserved for the second incomes, and $32.95 was carried forward. In 1905 and 1906 all three classes of income bonds received their full 5 per cent.; in 1904 the second preference received their first payment, 2 per cent.

The increase in operating costs was caused by increased costs of labor and materials, in addition to a condition both of local and of general congestion. Presumably on account of this congestion, the average train load of revenue freight decreased from 218 to 212 tons, although the average car loading increased from 13.52 to 14.60 tons. According to Mr. Hale's figures, the Georgia Central, for the first six months of the current fiscal year, made a good showing in percentage of cars in service, but a rather poor one in ton-miles per car per day, as compared with the other railroads in its territory. The ton-mile earnings for the year also fell off from 1.655 to 1.569, and the passenger-mile earnings from 2.455 to 2.419, and there is the unmistakable inference that, as the result of recent legislation in the southern states, these unit earnings are likely to show even a further decrease in the 1908 year. There is also a strong indication that taxes have been materially increased and are likely to figure still more largely next year, but they are lumped with general expenses, so the figures cannot be given.

In spite of this disadvantageous feature, the expenditures on maintenance account were consistently liberal, as they have been for several years past. The company has 40 more locomotives in service than it had a year ago, and spent an average of $2,460 for the maintenance of each of the 292 in use, including renewals, doubtless, but not the undistributed charge for superintendence, etc. The maintenance charge for cars in passenger service was on the basis of $914 per car, which is, of course, a very high average, and freight cars were charged at $102, which means that the amount spent for renewals under this head was greater than the amount spent for ordinary maintenance. Way and structures were charged at $824 per mile of main track operated, and at the rate of $727 per mile of single track, estimating, roughly, that two miles of spur tracks and sidings are equivalent in maintenance cost to one mile of main track. This is a good figure for the southern states, although much remains to be done, as indicated by the fact that the company had 531 miles of 56-lb. rail in service on June 30.

The following table of increased unit costs tells an important story, although it must be borne in mind that the congested conditions of traffic referred to above affected economical working unfavorably.



Central of Georgia.

Cost Per Mile Run; Cents.

	1907.	1906.
Wages of engineers and firemen	7.042	6.326
Wages of roundhousemen	1.471	1.209
Repairs	6.206	4.452
Fuel	9.996	8.214
Water supply	.490	.472
Oil, tallow and waste	.228	.186
Other supplies	.093	.073
Total, per locomotive-mile	25.526	20.932

The traffic returns show an increase of 33.41 per cent. in manufactures and miscellaneous freight carried; of 24.83 per cent. in forest products; of 19.86 per cent. in product of mines, and of 20.19 per cent. in products of agriculture; an excellent showing. Bituminous coal and manufactured articles have shown particularly noteworthy gains in the last few years; the total freight tonnage has doubled since 1900, and the bituminous coal tonnage has increased in seven years from 251,508 tons to 854,303 tons.

The total impression gained from a careful reading of the report is that the company is in excellent shape as regards its traffic, and is making up deficiencies in physical condition from earnings as well as from new capital expenditures, as fast as can be done, but that, in common with every railroad in the south, it is genuinely suffering from high costs forced upon it from the inside and from low rates decreed by legislative bodies, at the very time that it is of the most urgent importance, from the standpoint of railroad and commonwealth alike, that rates should be increased, to strengthen the company's credit and make much needed improvement work possible.

The following are the principal statistics of the year's operation:

	1907.	1906.
Average mileage operated	1,899	1,878
Gross earnings	$12,082,777	$11,396,123
Maint. way and structures	1,579,010	1,845,793
Maint. of equipment	2,249,318	1,712,132
Conducting transportation	4,887,176	3,892,830
General expenses and taxes	890,712	784,457
Operating expenses and taxes	9,606,216	8,235,213
Net earnings	2,476,561	3,160,910
Other income	311,939	274,621
Total income	2,778,500	3,435,531
Interest and rentals	2,340,374	2,184,860
Balance	448,126	1,250,671

NEW PUBLICATIONS.

Hendricks' Commercial Register of the United States. For Buyers and Sellers. Sixteenth annual edition. Cloth; 1,224 pages; 7x10 in. Published by Samuel E. Hendricks Co., 74 Lafayette Street, New York. Price, $10, express charges prepaid.

Hendricks' Commercial Register is designed to be a complete and reliable index of the architectural, mechanical, engineering, contracting, electrical, railroad, iron, steel, mining, mill, quarrying, exporting and kindred industries. The present volume contains over 350,000 names and addresses of manufacturers and over 15,000 business classifications with full lists of the manufacturers and of the dealers in everything employed in the manufacture of material, machinery and apparatus used in these industries. The publication is well indexed by the class of goods manufactured with sub-classifications by states. Thus, for example, a list of makers of gas engines, sub-divided into 29 states, is given. Eight manufacturers are named for so highly specialized a product as a screw pitch gage. The book is well planned and has apparently been carried out in a thorough manner. It is an extremely useful publication.

CONTRIBUTIONS

Curve Mechanics and the Woodlawn Wreck.

Waltham, Mass., Aug. 29, 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The communication on "Curve Mechanics and the Woodlawn Wreck," in your issue of August 23, suggests the following notes:

If the leading locomotive exerts a retarding force on the rest of the train, the direction of that force will be tangential and not in the direction I. G. (See figure on page 198.)

The reactions of the rails, through friction, are additional forces acting on the lever I F K, which have been ignored.

Under the worst conditions, with no brakes on any other vehicle of the train and with the driving wheels of the leading locomotive at the point of sliding, on a 3½ deg. curve, this retarding force will fall far inside the rear driver, its transverse component will be less than 1,000 lbs.; and, according to the transverse location of the resultant rail reaction, this 1,000 lbs. would be distributed among several or all of the wheels.

With brakes applied to all of the vehicles, the force acting between the locomotives is so small that it is uncertain whether it is one of tension or compression, depending on the percentage of braking power of the loaded vehicle and the coefficients of friction involved.

If such a force as that described by your correspondent had existed, it would have derailed the rear driver instead of the trailing wheel on such a curve as that at Woodlawn.

The difference between the forces required to guide the center of gravity of a body in a given path and those required to change the rotative velocity of the body about its center of gravity, has been lost sight of. The former is the centrifugal force, and the latter is the subject of Mr. Henderson's investigation.

All of the mechanical points in dispute in connection with the Woodlawn wreck have been of an elementary nature, and there is evident a need of much more attention to the subject of mathematical mechanics. G. E.

Complimentary Tickets.

New York, Aug. 28, 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In the *Wall Street Journal* I find the following:

It is difficult to persuade some people that there is a law against passes. Many still believe that they are entitled to free transportation, and some of these men are so important that railroad presidents find it impolitic to refuse their requests. One prominent railroad man [presumably a president] pays from $500 to $600 a month out of his own pocket to buy railroad tickets over his own road, to give to such applicants for passes as he feels unable to turn away.

This is as it should be. I assume that, of course, this $6,000 to $7,200 yearly expense is covered by the president's salary. (We ordinary officers, receiving from $3,000 to $6,000 yearly, are almost unanimous in the opinion that salaries of $35,000 to $60,000 can "cover" a contingent expense of $7,000 without damage to the social fabric.) If my assumption is correct, this president's policy puts the free-ride item on the same basis as "legal expenses" and other railroad expenditures which for years it has been deemed necessary to charge to some account where they will not be too conspicuous. In giving free passes and making no account of the mileage traveled on them, an injustice is done to the "conducting transportation" department. Unless the prohibition of gratuitous railroad service is going to be made to cover everything from 5-cent cigars to complimentary tickets allowing a non-passenger to walk up and down the train platform, the railroad company should have some place in which to charge complimentary rides; and the president's salary is just the place. If a railroad cannot give away anything whatever, why, it is time that President Roosevelt began paying fare for his wife and children on the "Mayflower."

But what if Professor Adams should decree that railroad presidents' salary vouchers be apportioned among the 238 different accounts into which he has classified railroad expenses! A. G. P.

The Brick Arch.

Cuyahoga Falls, Ohio, Aug. 16, 1907.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Permit me to have space in your valued paper to direct thought to this subject. It was referred to recently in a technical paper in the words in quotation marks, which prompt my comments in the words thereafter following:

"It is of interest to note that in the recent convention of the Master Boiler Makers' Association, the remarks of the speakers indicated a general abandonment of the brick arch in locomotive practice, chiefly because of the unreliability of arch tubes as generally applied, together with some vague impression that its use was detrimental to the back firebox sheets, and possibly the side sheets. To one unacquainted with the process by which devices rise and fall and railroads, in general, those conditions might appear somewhat absurd. But to those familiar with the idiosyncrasies developed on railroads, the conclusions are not surprising. The factor of fuel economy is given so little regard in this country that a very little trouble with any device tending to such an end is sufficient to condemn it."

It may be admitted as true that the "factor of fuel economy is given so little regard" on railroads, that they take very little trouble. But the boilermakers, having had daily opportunities for close observation, were able to speak at their convention from their own experience, and that experience, which would be legal evidence in a court of justice, should not be lightly discredited. Without commenting on their reasons, I would suggest thought on two other reasons why the brick arch should be abandoned:

First.—Carbon dioxide is one of the products of combustion. It is the resultant of the perfect union (combustion) of carbon and oxygen. It is not combustible. It is 50 per cent. heavier than air. In its own heat it has energy aided by the draught to rise and pass out of the firebox to the smoke stack, but if it has not sufficient heat to energize it, or if there be not sufficient draught to draw it out of the furnace, or if its exit from the furnace be hindered by a brick arch, it spreads over the firebox as a diluent, and the temperature of the furnace is reduced by its failure to fully move out with the draught.

Second.—The gases which rise from the firebed gain nothing by contact with a brick arch. Their tendency is to lose heat in touching a solid. JOHN LIVINGSTONE.

Reducing Black Smoke on Soft Coal Burning Engines.

The committee of the Traveling Engineers' Association, reporting on this subject, sent out to members a circular letter with questions, some of which were:

How do you prepare your coal before putting on tender?

How do you prepare your fire when starting train?

What grades of coal do you use?

Have you noticed any difference in the smoke with the different grades of coal.

Answers to the first question showed that only a few roads prepare their coal. Those that do get good results, the general method being to break the large pieces into lumps from 4 to 6 in. in diameter. One method which appears practical and inexpensive is to provide coal sheds with breakers made by placing ¾ in. x 3 in. iron bars set on edge about 5 in. apart. On these breakers the coal is dumped and must be broken into pieces less than 5 in. in diameter before it will fall through. The value of such practice should not be overlooked by railroad companies.

In answer to the next question, almost without exception the same plan is advocated for preparing the fire. It is built up gradually until a good level bed of coals is secured of sufficient thickness to hold without tearing under heavy exhaust, and thereafter the use of the single scoop system in replenishing the fire. When stops are made the fire should be in such prime condition that it will not be necessary to put on much green coal when starting train, and the engineer should use every effort to assist the fireman in holding his fire by pulling out carefully, and when the stop is to be a short one the fireman should endeavor to have his fire in such condition that no green coal need be added until the train has left the station. The blower should be used to pull just enough air through the fire to combine with gases, and grates and ash-pan should be kept clean and in good condition. The condition of grates has much to do with the suppression of black smoke.

The replies to the third question show that probably the great-

est stumbling block in the way of eliminating black smoke is the grade of coal used by the roads and the use of a great many different grades on a single system. The poorest grades of coal seem to be received by most of the roads, and as many as 17 or 18 different grades on a single road. Since this is the case, the problem of reducing black smoke is even more troublesome than it should be. A fireman who gets one grade of coal trip after trip so that he can get accustomed to using it to the best advantage, even if it is of the poorest quality, can get better results than the fireman of equal ability who gets a good grade of coal on one trip and a poor grade on the next.

Only one report indicated satisfactory coal conditions. In this instance 50 per cent. of bituminous and 50 per cent. of anthracite coal was used, and little trouble was experienced from smoke, as it could be regulated by increasing the percentage of anthracite at times when excessive smoke was objectionable.

The last question is supplementary to the one preceding and the replies further prove the disadvantage of having several grades of coal to contend with. Fine coal is found to produce more smoke than lump, as it ignites more rapidly and the smoke and gases formed have less chance of being burned off. This is also true of the lighter grades as compared with the heavier. Also, it is more difficult to prevent smoke with coking coal than with no coking, and still more difficult with slack coal.

On roads where several grades are in use there is no benefit derived from the use of the best grades except in that they produce steam more satisfactorily, and the better the grade of coal the more carbon it contains and the more smoke it will discharge. This is only true, of course, because the fireman does not get the good coal frequently enough to become accustomed to firing it properly. If the better grades were used exclusively and the firemen became acquainted with the right method of handling it, much less smoke would result and lighter firing would be possible.

In summarizing the report, the committee advocated the serious consideration of two things:

First, a campaign to bring about the standardizing of grades of coal furnished for locomotives. That, both in the line of economy and convenience, better grades of coal would be desirable is unquestionable, but if managements cannot be brought to realize the economy of good coal or if it is impossible to obtain it at all times, efforts should be made to insure the furnishing of one particular grade at all times in place of from half a dozen to twenty different varieties. No mechanic on earth could turn out satisfactory work if tne style and pattern of his tools were changed daily, and it is just as impossible for the fireman to do himself justice or work for the best interests of his employers if a continual change is being made in the kind of fuel he must use.

Second, a realization of the fact that the present tendency toward still heavier power must necessitate a change in the old methods of handling a locomotive. Mechanical devices to assist the fireman in the duties that now overtax his strength must sooner or later be put in use, both in the interest of economy to the company and in fairness to the engineer. What devices will best accomplish the uesired results is still a question, for the reason that the managements of railroads are backward in taking up anything that looks like an additional expense in maintaining power, while the mechanical departments dread the trouble and nuisance of experimenting with new devices. The enginemen themselves are probably as much to blame as any one for blocking changes that are bound to come at no distant date. New conditions to-day are making necessary new devices, and the really progressive railroad man will meet the conditions and do all that he can to discover which are the best means of making it possible for the fireman to fire his engine as it should be fired to prevent black smoke, to hold his steam and to waste as little coal as possible.

The report is signed by Jno. Lynch, chairman; W. H. Bradley, C. L. Brown, Martin Whelan and W. J. Toy.

Disastrous Collision Near Charleston, Ill.

In a butting collision between a passenger car, with a trailer, and an express car, on the Charleston & Mattoon Interurban Electric Railroad, near Charleston, Ill., on Friday last, 14 passengers were killed and 65 were injured. The collision occurred on a sharp curve, and the passengers had neither warning nor chance to escape. So high was the speed with which the cars approached each other that the crowded motor car and trailer were both completely wrecked. A misunderstanding of telephone orders is said to have caused the disaster. The line on which the collision occurred is but twelve miles long. Telephones are placed every few miles, by which orders are transmitted to conductors and motormen passing over the road. Who is to blame for the confusion of orders is not stated. This is said to be the third disastrous wreck on this line in the last two years, all caused by cars meeting on curves. As a result of the last one, John A. Backus, who was in charge of the despatching system, committed suicide.

Two Strike Documents.

During the present strike of commercial telegraphers, the wires have been kept open through the good services of loyal employees, junior officers of the company and volunteer telegraphers of experience. The men handling the keys at the central office in New York are well known to the strikers, who watch their movements closely. One of these men has handed us a copy of the following "Summons," which he believes was sent to every one at work last week.

SUMMONS

FROM THE REAL FRIENDS OF THE NON-STRIKERS:
READ IT CAREFULLY—PONDER IT WELL.

Do you realize that you have been charged in the Court of Human Nature with the highest form of crime known to mankind—Treason—a crime against humanity?

If you are pronounced guilty do you know what the penalty will be?

It is because the history of the world, in all days and among all races of people, barbarian and civilized, says with a unanimous voice of thunder:

> Ye who are ostracised, shunned and hated by every man, woman and child, your relatives, brother, sister, father and YOUR MOTHER. Ye, indeed, shall suffer the tortures of the severest punishment known this side of hell.

It is because we do not want TO PASS this terrible SENTENCE upon you WITHOUT A TRIAL that we hand you this notice.

You are hereby summoned to appear at Room 307 . 56 Pine St.
on or before 12 o'clock noon Tuesday Aug 27. 1907
TO ANSWER THE CHARGE MADE AGAINST YOU. If you appear we shall listen with care and sympathetic consideration to your defense.

If you do not appear, you shall be adjudged guilty by default.

What is your answer?

God Almighty made Hell for Traitors. Pray to God to give you light and strength.

We know that seductive influences have been at work on your feelings; that you have been coaxed or bulldozed; that every form of lie within the scope of the imagination of a soulless corporation has been told you, but we can not believe that you have been bought with a box of candy or a cigar. Perhaps money, the curse of an imperfect civilization, has played its part with a few of you, but we are charitable, as to the majority, and honestly believe that the horrors of THE COMPANY'S BLACKLIST, pictured to you, no doubt, with corporation ingenuity and inhumanity, has had its effect.

Still frightful as the Company's Blacklist may be, it is as day to night when compared with THE BLACKLIST OF MANKIND—LIVING DAMNATION!!

Why not come and be one of us? ALL WILL BE FORGIVEN.

With anxiety for your future welfare, we are

Yours,

THE COMMERCIAL TELEGRAPHERS' UNION OF AMERICA.

To this fervid appeal to avoid living damnation and to come and be forgiven, the following reply was made:

New York, N. Y., Aug. 29, 1907.

THE COMMERCIAL TELEGRAPHERS UNION OF AMERICA,
56 Pine Street, New York City.

Referring to the "summons" to appear in room 317, No. 56 Pine street, on or before 12 o'clock noon of a certain day to answer the charge of treason, etc.

Treason is a crime committed against a state or government, to whom the party accused owes allegiance. Do you have the supreme impudence to assert that we owe allegiance to you? Have we ever authorized *you* to act as sponsors, to dictate what we shall, or shall not do? Who gave you the authority to direct the affairs of your fellowmen?

The constitution of this land guarantees to all life, liberty and the pursuit of happiness, and we are controlled and regulated only by the laws made by the duly accredited representatives of the people. Your body does not represent government, nor order, and you have no authority to "hereby summon" any one, by any right whatsoever, unless it be by the red flag of anarchy, and by that treason of which you yourselves are guilty, in thus arrogating to yourselves the laws of God, and of your country, in a criminal attempt, by threats and high-sounding phrases, to deprive a few men of the right to mind their own business. You say "God Almighty made Hell for traitors." This is correct, and while you are warning others to be careful of yourselves, for if ever a crude composition bore the imprint of his satanic majesty's press, your circular does.

"Treason"; just why you attempt to apply this word to those who are faithful to their trusts, while your small clique are the ones who have actually undertaken a rebellion, is a mystery, except that perhaps in your "lost cause," it is a last desperate attempt to intimidate those who are endeavoring to be loyal to their employers.

Then there is that other word which you use, "Deserter." The definition of which is "one who leaves his position, his party, or his friends, particularly a soldier or seaman, who quits service without permission and in viola-

tion of his agreement." This is exactly your predicament. You have forsaken your position and quit the service without permission, and in violation of your obligations. If we operators now at work were in a similar position, and had received a summons from the company to answer such a charge, we would without doubt appear before the proper officers with an appeal for forgiveness. Our position, however, is reversed. *You* are the so-called "soldier," or "seaman," in the case.

You ask "why not come and be one of us," to which we reply,—because yours is a *lost cause*, and you are unable to control or retain those who have previously allied themselves with the union.

We ask, why be so foolish as to prolong this controversy, depriving a few honest men from earning a living to support their families, who are made "victims," when there are daily those being employed by the telegraph companies who are assigned to the good positions which you have deserted? In a word, who pays your salary when you are not working?

A LOYAL EMPLOYEE.

P. S.—I request that this letter be published in your publication entitled "Fair Play."

Wire Testing.

BY L. M. JONES,
Assistant Superintendent Telegraph, A., T. & S. F.

In the successful operation of a telegraph system, carrying, as most systems do, a volume of business almost equal to the capacity of the facilities under favorable conditions, it is of the utmost importance that all the wires available be kept in use as nearly all of the time as possible.

To do this, some one must be made responsible for all delays in locating and removing trouble, which can best be done by the division of the territory into wire testing districts.

The proper location of the wire testing offices is very important, as there are usually many things to be taken into consideration. Almost invariably there exists on every wire testing district a necessity for repeaters or quadruplex apparatus, and in order to have these located under the direct supervision of the wire chiefs, the office is located where the repeaters and multiplex apparatus are required.

In order to secure the best results, the hours of duty should not be such as to overtax the physical ability of the wire chief. The 24 hours may best be divided into three tricks of eight hours each, corresponding with those worked by train despatchers. The first trick, 8 a.m. to 4 p.m., can be taken care of by the manager of the office, with the dual title of wire chief and manager; the second trick, 4 p.m. to midnight, and the third trick from midnight to 8 a.m.

The wire chief and his assistants, to be successful, must, in addition to having had experience in wire testing, be fully posted in the handling of multiplex apparatus.

One thing very essential to the successful wire chief is patience. Few operators at way offices understand thoroughly their switchboards and circuits even when regular, consequently when asked to make a patch, they lack confidence in their own ability, and should the wire chief lose patience, the result will probably be a wrong connection, and the loss of much valuable time. Each wire testing office should be supplied with, in addition to a spring jack switchboard and spare sets at the board for testing purposes, a milammeter and voltmeter of suitable scale ranges.

In the location and clearing of trouble, the methods in use are much the same everywhere; however, I will enumerate separately those which are usually followed, and from which satisfactory results are obtained.

FOR A GROUND.

The margin or pull of the relay magnet will give you a good idea as to whether the wire is grounded near you; then proceed by having offices open the wire until the ground is located between two offices.

FOR AN OPEN CIRCUIT.

If the circuit is a comparatively long one, and paralleled by other working circuits, place your voltmeter in the circuit for a moment. If near you, the needle will remain almost stationary; if very unsteady, the open place is probably some distance from you. Or, place the open wire on a battery of preferably more than 100 cells, then cut in a test set and let the relay spring down low, opening and closing your key. If the break is comparatively close, a very short dot will follow the opening and closing of the key; if further away, the dot will become perceptibly plainer, increasing with the distance from the test office to the open. A large number of relays in the circuit, however, will detract from the sensitiveness of this latter test. This will save time in tracing for the location. Have different offices ground the wire until located in an office, or between two offices. If the wire is broken between offices, one end will usually touch the ground and remain grounded, while the other will remain open. This, if known, will give you a good idea as to the location outside of an office. However, the usual office tests should be made.

FOR A CROSS.

When two or more wires are crossed, have the distant terminal open all wires affected except the most important wire affected. Then locate by having different offices open one or more of the wires which are cut. When located between offices, have the usual office tests made to be sure it is outside.

FOR AN ESCAPE.

An escape may be either an escape to a ground, or to another wire. An escape to a ground is located in the same manner as a ground. An escape to a cross is located the same as a cross. If only slight, it may only be felt with a voltmeter and resemble closely poor insulation.

OFFICE TESTS.

In testing for trouble in an office, first have the wire cut out at the bottom of the board, removing the instrument plugs. This will clear the wire if trouble is not in the board. If this does not clear it, have the wires removed from the top of the board and the ends twisted together. This will clear if in an office. The same test at the other of the two offices between which the trouble was located will definitely locate it outside of an office.

To clear a switchboard of a burned lightning arrester, remove the grounded wire temporarily until the plate can be removed and filed or scraped, and insulated with mica. If an office has hinge or gate cutouts instead of a switchboard, the wire should first be cut out, then if the trouble does not disappear, the removal of the ground wire from the cutout will have the same effect as taking the wires out of the top of the switchboard. A plug cutout or one-wire board should be handled in the same manner as a switchboard.

Wire chiefs often complain of failure of operators to follow instructions, especially when requested to remove wires from the top of switchboards and cutouts. This is sometimes due to the fact that linemen have used pliers to tighten nuts, and the operator not having a pair, is unable to take the wires out, and rather than tell the wire chief he cannot do so, makes a bluff by waiting a sufficient length of time and probably saying, "Now," leading the wire chief to believe the wires have been removed.

In order that a lineman may not be given a wrong location, for example, the day chief locates trouble on his district, which, the lineman being at some distant point, and train service such as to make it impossible to reach the trouble before dark, instead of notifying him at once, transfers the trouble to the second trick chief; he re-tests and transfers to the third trick chief, who re-tests and notifies the lineman. In this way, no time is lost in clearing the trouble, and the lineman is not disturbed in case the wire comes clear in the meantime. If an interruption is reported to a lineman by the first or second trick chief, and he fails to clear the trouble before dark, he reports this to the wire chief on duty. The wire should then be re-tested and the lineman advised if still in, or of any new developments.

All wires should be tested by the third trick chief before daylight. Linemen understand if no trouble is reported to them none exists, leaving them free to carry out any projected work on hand.

The train wire is of first importance, and must be made good, if need be at the expense of everything else. The through quadruplex wires are of next importance. After locating and patching trouble out of a circuit, the patched circuit should not be again disturbed until it is known that the trouble has been removed. However, the section where trouble exists must be watched closely and tested frequently without waiting for the lineman to call for a test. In testing, the through circuit should be left intact, and the section where the trouble existed tested by using a local circuit.

When cleared and circuits are regular again, if a quad wire, the offices having the quad sets should be notified at once in order that a new balance may be taken, if necessary. The taking out of 50 or 75 miles of iron wire from a copper circuit often working on a very narrow margin may so affect the balance as to make the wire almost unworkable.

In order that there may be no delay in clearing wire trouble, it is necessary for the wire chief to at all times know the exact location of the division line repairer. Early each morning, say 7 a.m., each line repairer should file a work report giving movements for the day, stating explicitly just where he will be, and on what trains he will move, if away from headquarters, advising the wire chief immediately of any change in his plans.

In case of unusual conditions prevailing, wire chiefs should be authorized to direct the movement of construction or repair gangs, as communication with the superintendent's office may be entirely cut off by wire trouble at any time. In case of a sleet storm, or any unusual interruption affecting all wires, so as to cut off communication with the general office, each wire chief should immediately advise his superintendent fully of the conditions on his own district, and continue to do so at intervals until communication is again restored, using Western Union or Postal wires, if working. If all commercial wires are down the telephone toll lines should be used if available.

I have noticed a tendency on the part of some wire chiefs to

discourage operators calling for a balance, which often results in operators working for some time on a wire almost unworkable, which could be remedied by a balance, and its capacity often doubled.

The third trick chief should, in addition to testing all wires early in the morning, carefully inspect his repeaters and quadruplex apparatus, especially the points of his pole changers and transmitters, and balance his quadruplex sets, for the reason that during the early hours of the morning possibly only one or two corners have been in service, and the wires are too busy to be taken out of service for this purpose after the arrival of the first trick chief. While the use of files for cleaning points is very necessary at times, it should be borne in mind that a clean smooth point is by far more desirable than a clean rough one, or one with sharp edges or corners.

Once a week all wires should be measured for insulation and current strength of different circuits measured. Quad batteries should also be measured, compensating resistances of quadruplex sets adjusted, and a full report mailed to the superintendent of telegraph. For insulation tests a battery of approximately 100 cells should be used, all wires to be removed from this battery while being used for this purpose. The wires should be removed for the reason that otherwise the current strength will vary, being governed by the demands upon the battery, due to the opening and closing of the other wires.

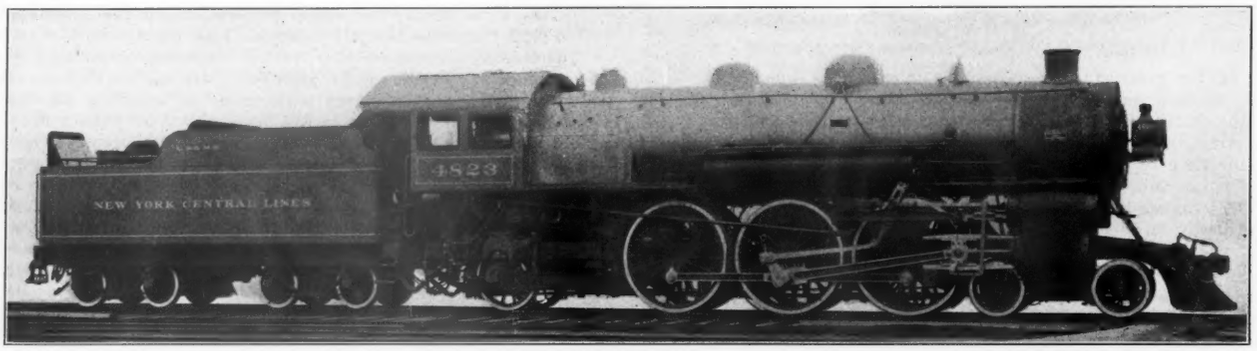
In making insulation tests we use a battery of 100 cells if available, or a current of 90 volts potential, inserting a voltmeter in the different circuits, having the distant terminal open the wire, noting and recording its deflections. If the needle shows an escape, intermediate offices are called in until the point of escape is located as nearly as possible. The lineman is then advised and instructed to report when covered. Upon receiving his report the wire is again tested and the lineman advised of the result.

The current readings are taken by inserting a milammeter in the different circuits while conditions are as nearly normal as possible. In this way we secure a report showing the actual amount of current being furnished for the operation of each wire.

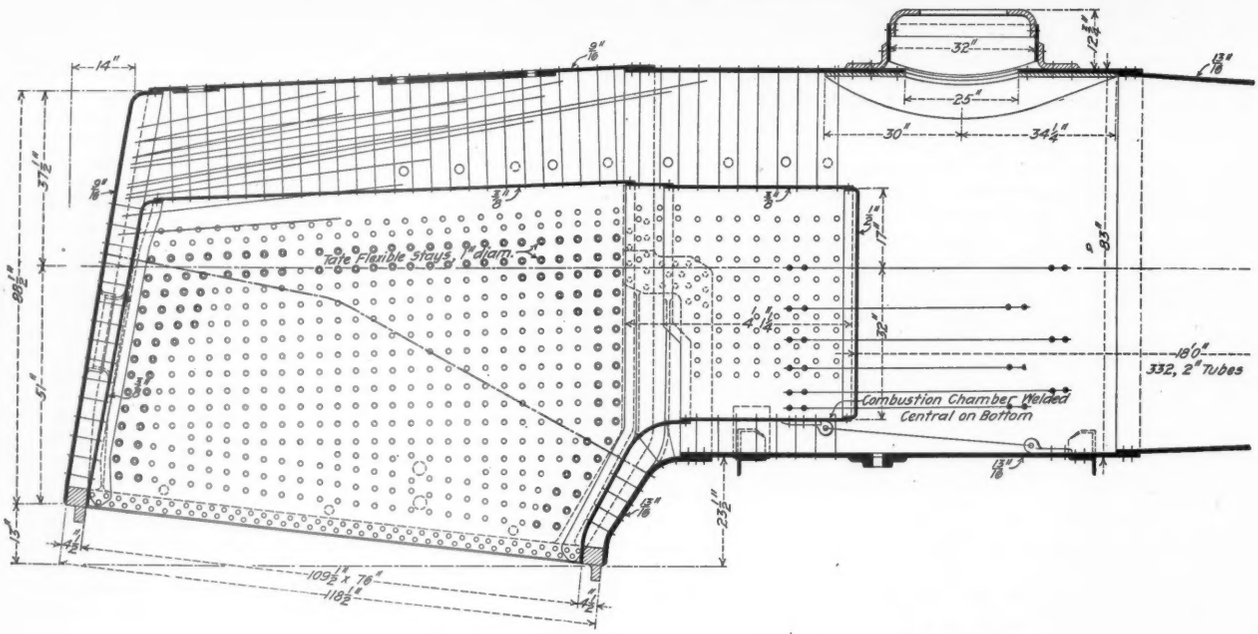
Pacific Locomotive for the Lake Shore & Michigan Southern.

In 1901 the first prairie locomotive on the Lake Shore & Michigan Southern was put in service. Since that time it has been the favorite type for heavy passenger work. Recently an order was given to the American Locomotive Company for 25 Pacific engines, one of which is illustrated here. The engine is interesting as marking the introduction of a new type on the Lake Shore and also because some of the new engines have the combustion chamber in the firebox, a feature that is being tested in a number of places. Also, these engines are the heaviest passenger engines the builders have ever made, excepting those of the same type built for the Pennsylvania.

As compared with the heavy prairie engines already alluded to, these new locomotives have about the same weight on the driving wheels and carry the same boiler pressure, but, with cylinders ½ in. larger in diameter, they have a greater tractive power. As three of the order are to be fitted with combustion chambers and as there will be but little difference in the equated firebox heating surface, this order will afford an excellent opportunity for checking the action of the boiler with and without the combustion chamber.



Pacific Locomotive with Combustion Chamber; Lake Shore & Michigan Southern.



Firebox of Boiler for Pacific Locomotive; Lake Shore & Michigan Southern.

The following table gives the ratios and some of the principal dimensions of the Pacific engines with and without the combustion chamber and the prairie engines that have been used up to the present:

		Pacific	
	Prairie.	Without combust'n chamber.	With combust'n chamber.
Total weight, lbs.	244,700	261,500	261,500
Weight on drivers, lbs	170,000	170,700	167,000
Tractive effort, lbs.	27,850	29,200	29,200
Cylinders, diameter, in.	21½	22	22
Piston stroke, in.	28	28	28
Drivers, diameter, in.	79	79	79
Total heating surface, sq. ft.	3,905	4,195.0	3,409.3
Tube, heating surface, sq. ft.	.....	3,960.6	3,112.5
Firebox heating surface, sq. ft.	.....	206.2	268.4
Arch tube heating surface, sq. ft.	.....	28.4	28.4
Grate area, sq. ft.	55	56.3	56.3

$\frac{\text{Weight on drivers}}{\text{Tractive effort}}$ =	6.1	5.83	5.72
$\frac{\text{Weight on drivers}}{\text{Total weight}}$ =	69.47	65.01	65.01
$\frac{\text{Total weight}}{\text{Tractive effort}}$ =	8.8	9.03	9.03
$\frac{\text{Tractive effort x diameter drivers}}{\text{Heating surface}}$ =	563.9	350.0	675.9
$\frac{\text{Heating surface}}{\text{Grate area}}$ =	71.0	74.5	60.5
$\frac{\text{Firebox heating surface}}{\text{Total heating surface}}$ =	.....	4.91	7.87
$\frac{\text{Weight on drivers}}{\text{Total heating surface}}$ =	43.6	40.6	48.9
$\frac{\text{Total weight}}{\text{Total heating surface}}$ =	62.7	62.4	76.7
Volume of two cylinders, cu. ft.....	11.76	12.61	12.61
$\frac{\text{Total heating surface}}{\text{Volume two cylinders}}$ =	388.0	340.0	276.0
$\frac{\text{Grate area}}{\text{Volume two cylinders}}$ =	4.68	4.46	4.46
$\frac{\text{Firebox heating surface}}{\text{Tube heating surface}}$ =	6.17	4.92	8.62
Tube heating surface equated to firebox heating surface (Vaughan formula).....	.....	888.3	734.1
Total equated firebox heating surface.....	1,061.0	1,091.0	1,002.3
Ratio equated to actual heating surface	1—3.68	1—3.84	1—3.41
$\frac{\text{Tractive effort x diameter drivers}}{\text{Equated heating surface}}$ =	2,070.0	2,114.0	2,302.0
$\frac{\text{Total weight}}{\text{Equated heating surface}}$ =	230.0	239.0	260.0

It will be noticed from this table that in the Pacific engine without the combustion chamber 340 sq. ft. of heating surface has been provided for each cu. ft. of cylinder volume. This is a trifle more than was allowed in the prairie engine and considerably more than in the Pacific having a combustion chamber. But if we compare them on the basis of equated heating surface, the figures become: 98.72 sq. ft. for the prairie, 86.52 sq. ft. for the Pacific without the combustion chamber, and 79.48 sq. ft. for the one with the combustion chamber. This means that experience with the combustion chamber has shown that the boiler is slightly more efficient with it than without it, as indicated by the Vaughan formula, a variation that might well be due to an increased efficiency of combustion due to the larger volume of the firebox, as has been pointed out previously.

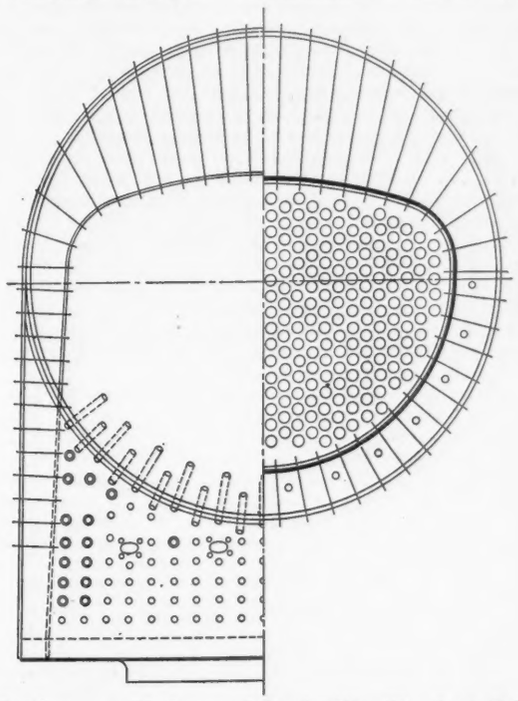
The difference in boiler ratios between the prairie and Pacific engines without the combustion chamber is insignificant, as in designing the latter, especial attention was given to provide the same satisfactory proportions that had obtained in the older engine. The boilers with the combustion chamber are radial stayed with conical connection, the outside diameter of the first or smallest course being 72 in. Those without the combustion chamber have 379 tubes, 2 in. in diameter and 20 ft. long. The boiler with the combustion chamber, shown in the accompanying illustration, is exactly like those of the other engines of the order, excepting the introduction of the combustion chamber and a reduction in the number and length of the tubes. The tube sheet has been moved ahead so that the tubes are 18 ft. long, or only 2 ft. shorter than in the engines without the combustion chamber, although the combustion chamber is 4 ft. long. The number of tubes has been reduced to 332. These changes reduce the tube heating surface 848 sq. ft., or 21.4 per cent., while the firebox heating surface is increased 62 sq. ft., or 33.4 per cent. Results from the use of the combustion chamber on the Northern Pacific have shown that the increase in firebox heating surface fully offsets the decrease in tube heating surface and the evaporative efficiency of the boiler is in no way decreased. The relative steaming qualities of the two boilers here described are best shown by a comparison of the figures for equated heating surface in the above tables. These figures are obtained from H. H. Vaughan's formula which equates the total firebox heating surface to the tube heating surface divided by the square root of the length of the tubes in feet. By such a comparison, it will be seen that although the total actual heating surface has been reduced 786 sq. ft., or 18.7 per cent., the total equated heating surface has been reduced only 89 sq. ft., or 8.1 per cent., which would indicate that the engine with combustion chamber will steam fully as well as those not so equipped.

As will be noticed in the illustration, the combustion chamber is stayed to the shell of the boiler by radial stays on the bottom and sides and expansion stays on the upper section. A number of 1⅛ in. rod braces between the chamber and the shell of the boiler serve to further stiffen it. The water space between the chamber and the shell of the boiler is about 8¼ in. at the bottom and 7 in. where the chamber is nearest the sides, which gives ample space for good circulation.

There are two rows of flexible staybolts at the ends and top with clusters in the upper corners. The use of the bolts at the top and ends and in clusters at the corners is standard practice, but as to whether there shall be one, two or three rows seems to be a matter of personal judgment with no agreement of individual opinions. The bolts are put in where experience has shown that most stays break, and these places, of course, are those where the distance between the inner and outer sheets varies most. It would appear that the better combustion resulting from the use of the chamber would raise the temperature at the front end of the firebox and thus expand the sheets more than in a similar boiler without the combustion chamber, so that more flexible bolts should be used.

The application of the combustion chamber to these engines, as well as to two of a duplicate order of 20 for the same road, and to the six decapods recently built for the Buffalo, Rochester & Pittsburg, shows the increasing popularity of this feature as a means of reducing boiler trouble.

Another interesting feature of the design is the arrangement of the Walschaert valve gear. This is similar to that on the Pacific



Half Sections at Firebox and Combustion Chamber; Boiler of Lake Shore Pacific Locomotive.

locomotive built for the Pennsylvania by the same company. The link is just back of the center of the forward driving-wheels and is supported on a steel casting outside of them extending between the guide yoke and the frame cross-tie located between the first and second pairs of driving wheels. The reverse shaft is supported on the back end of this same casting and the reverse shaft arm is directly connected to the radius bar by a slip joint.

The following are some of the dimensions common to both classes of engines, those with and those without the combustion chambers, in addition to the list given in the table above:

Weight of engine and tender (working order	423,700 lbs.
Journals, driving	10½ in. x 12 in.
" engine truck	6½ " x 12 "
" trailing truck	8 " x 14 "
" tender	5½ " x 10 "
Steam pressure	200 lbs.
Firebox, length	9 ft. ½ in.
" width	6 " 3¼ "
" thickness crown, side and back sheets	⅜-in.
" thickness tube sheet	½-in.
" water space	4½ in.
Smokestack, height above rail	14 ft. 7⅞ "
Tank capacity, water	8,000 gals.
Tank capacity, coal	14 tons
Valve travel	6 in.
" lap	1 1/16 "
" lead (85 per cent. cut-off)	¼ in.
" exhaust clearance	1/16-in.
Exhaust nozzle, diameter	5½ in. and 5¾ in.
Wheel base, rigid	14 ft.
" " total engine	36 ft. 6 in.
" " engine and tender	67 ft. 10¼ in.

The Risks of the Trade.*

If a farmer sends two of his hired workmen to the woods to chop timber and one of them carelessly lets slip his hold on the ax, sinking the blade into his fellow workman's leg, it would strike the average intelligence of mankind as unjust to hold the farmer liable or accountable in damages to the injured man. It is not easy to distinguish such a case in principle from the case of a man engaged in driving rivets in a boiler shop, who carelessly lets slip his hold on the handle of the hammer and strikes out his fellow workman's eye; or from the case of a switchman working for a railroad company, who in a moment of carelessness leaves the switch open and derails an on-coming engine, injuring the engineer. Yet many of the states have enacted statutes making the employer of labor on railroads or in factories or in mines, absolutely liable to an employee injured by the personal carelessness or negligence of his own fellow workmen.

In June of last year the Congress of the United States passed a law applicable to railroads engaged in interstate commerce, more drastic in its provisions than any legislation heretofore enacted by any of the states—providing upon this particular subject, in effect, that the fact than an employee was injured or killed solely by the negligence of his own fellow workmen should constitute no defense to the railroad company. This was followed up by the President of the United States in his last annual message to Congress, in which we find, among other things, the following forcible expression:

"Among the excellent laws which the Congress passed at the last session was an employer's liability law. It was a marked step in advance to get the recognition of employers' liability on the statute books, but the law did not go far enough. . . . Compensation for accidents or deaths due in any line of industry to the actual conditions under which that industry is carried on should be paid by that portion of the community for the benefit of which the industry is carried on—that is, by those who profit by the industry. . . . It is therefore clear to my mind that the law should place this entire 'risk of a trade' upon the employer."

Before this Federal statute, so heartily approved by the President was six months old, and within 30 days from the delivery of the President's message, the law was declared by two Circuit courts of the United States to be unconstitutional. The high commendation the law had received at the hands of the President did not in any degree tend to cure its obvious and glaring illegalities, nor affect to any appreciable extent the opinion of the bench and bar upon the subject.

In the state of Pennsylvania no employee injured by the personal negligence of another employee can claim any right to compensation for his injury, from their common employer; no matter what the rank of the negligent employee may be, whether superior or inferior of the injured servant, except only, such employees as are injured by the negligence of heads of departments. A number of other states adhere to this principle with more or less consistency. The theory which has governed legislation and actuated the courts of Pennsylvania on this particular branch of the law of negligence is this: that it is better for the working man, to enforce such laws as will have a tendency to prevent accidents and casualties and the consequent maiming and death of employees, than to afford to an injured employee compensation after he has been hurt; that an ounce of prevention is worth a pound of cure.

Proceeding on this general theory, it is consistently held in Pennsylvania that when an employee knows that if he is injured by the negligent act of a fellow servant he must look alone to that fellow servant for redress, when he knows that if his own negligent act injures a fellow servant, the injured man must look alone to him for redress; thereby a powerful and effective incentive to vigilance, forethought, attention and care on his own part is ever present, constraining him to the utmost precaution for his own safety and imperatively moving him, by vigilance, to detect repeated acts of forgetfulness on the part of his fellow servants likely to injure him or others, and to promptly report them. It is the theory and the practice of the Pennsylvania law that this tends in the first instance to preserve the lives and limbs of the working men. So far indeed has the legislature and the courts of Pennsylvania carried this principle, that since 1868 there has stood upon the statute books of Pennsylvania a law which provides: "That if any man who is employed by a third person to work about the railroads, depots, cars or premises of a railroad company, shall be injured by a railroad employee, that his rights to recover against the company are only such as they would be if he were employed by the company," and of course the effect of that statute is to make the many thousands of men who are employed in mills, furnaces, yards and elsewhere about the tracks and cars of railroad companies, fellow servants of trainmen, and for their negligence injuring any of these there can be no recovery. The argument is that inasmuch as these men are subjected to precisely the same risks as railroad men, working shoulder to shoulder with them, loading cars, unloading cars, or working upon cars, that the same motive of vigilance, care and attention will have the same salutary and preventive effect, if their rights against the employer are thus limited. This statute has been viciously assailed by text writers and more than once denounced by courts of foreign jurisdiction.

An interesting case involving this statute was not long ago decided by the United States Supreme Court. A postal clerk employed by the Government, while working on a mail train running between Cleveland and Pittsburg was injured by the derailment of his train which ran into an open switch, carelessly left open by a railroad switchman. He brought suit against the railroad company in Ohio for heavy damages, and it came within the scope of my employment to defend the case for the railroad company. As the accident happened in the state of Pennsylvania, the railroad company pleaded that the law of Pennsylvania governed his rights; that he was employed by a third person, that is, the United States Government, to work upon a car of the railroad company; that under the statute of 1868, to which I have already alluded, his rights were such only as they would have been if he had been employed by the railroad company, and that such being the case, he was a fellow servant of the switchman who left the switch open, and for the negligence of that switchman the railroad company was not liable under the laws of Pennsylvania. The plaintiff in reply admitted all this, but averred that the statute of 1868 was contrary to the Constitution of the United States, in several respects; that it was an attempt of the state to regulate interstate commerce; that it deprived the plaintiff of equal protection of the law; and that it deprived him of property without due process of the law. The case was tried through all the courts of Ohio, and through the Supreme Court of that state—every court holding that this statute was not unconstitutional, but was valid, and denied a recovery against the company. The plaintiff then proceeded, doubtlessly aided in his litigation by the postal clerks' union, to the Supreme Court of the United States, where the case was argued in Washington last November. In December the case was decided, the court holding that the statute was in accordance with the Constitution of tne United States, and in accordance with the amendments thereof, and was in no wise violative of any of the provisions of the Constitution, and that the plaintiff could not recover.

Turning now to the state of Ohio, we find the fellow servant law still existing, but much diluted by judicial refinement and legislative amendment. There the question of liability turns upon the rank of the negligent servant. If an employee having any authority whatever to direct another servant, inadvertently injures him, the company is liable; or if one servant who has control over another carelessly injures a servant over whom he has no control, but which servant has no control over anybody else, the railroad company is liable. The result is, to take a familiar illustration: If a train be moving through Ohio toward the Pennsylvania line and a conductor through some act of inadvertence or carelessness, no matter what, injures one of his brakemen, the company is absolutely liable in damages to the injured employee; but if before the accident happens the train has moved, even ten feet, across the line into Pennsylvania, and the employee is injured in the same way, there is no liability whatever upon the part of the company.

All over the United States the same contrariety of judicial decisions, and the same conflict of statutory laws prevails. Of course it goes almost without saying that if injury or sudden death overtakes a workman by reason of some negligence on the part of his employer to repair broken machinery, or cars or appliances, or to make the place of work reasonably safe for that purpose, the employer is absolutely liable, and justly so; or if the employee fails to observe the precautions and safeguards prescribed by Congress or by the state legislatures, such as the using of automatic couplers, or automatic air brakes, certain required hand holds upon its cars, guards or fenders over exposed cog wheels meshing into each other, or railings or shields about revolving wheels or cranks, or saws, in all these instances, injury or death arising from their absence creates liability. Yet all this is subject to one very material condition. If the employee knows that a machine is defective, or broken, or out of order, or that the safeguard has been omitted, and continues to work with it, or about it, without obtaining promise to repair the defect, and is injured by it, he is conclusively held to assume the risk of that danger and cannot recover.

Referring again to the suggestions of the President of the United States contained in his last message, we find the following recommendation: "If the entire 'trade risk' is placed on the employer, he will promptly and properly add it to the legitimate costs of production, and assess it proportionately upon the consumers of his commodities." Thus the employer of labor in the United States would be an insurer of the safety and the lives of his employees. The employer would make compensation for injury or death, whether the accident resulted solely from the negligence of the unfortunate person, or from the negligence of another workman, or from the master's negligence. This proposition is not so startling as at first blush it appears. If the President had gone further

*From a paper read before the Railway Club of Pittsburg, by James P. Wilson.

and suggested a fixed scale of indemnity, reasonable in amount, and graduated according to the extent of the injury, or in case of death, determinable by the decedent's earning capacity, so that the employer thus made an insurer might know the exact extent of his liability, so that he might in all instances insure against it and tax the amount of premium he pays to the trade, he would then, in effect, have recommended the adoption in this country of that policy and practice, which has for many years been adopted and enforced in many of the countries of continental Europe. In Belgium, Norway and Sweden, Switzerland, France and Germany, and of late in Great Britain, legislation is constantly tending to a universal liability of employers for injury or death to the employee, in any of the industrial arts, regardless of the manner of the accident, or whether it resulted from the negligence of the injured party, or his fellow servant, or his employer. In all of those countries, however, the amount to be paid in each specific instance, whether of injury or death, is graduated and determined by a fixed and unalterable scale, being in general a certain percentage of the previous earning capacity of the unfortunate employee, varying according to the extent of the disability, whether temporary or permanent; or in case of death, by the previous earning capacity of the deceased, and the amount of compensation exacted by law of the employer is so reasonable and moderate that, as a matter of general experience, the aggregate amount paid by the employers of labor, under the continental system, is absolutely less than the amount paid by the employers of labor in America, who pay upon the theory that only those who are deserving of compensation shall be paid.

In Norway and Sweden the government insures all workmen against accident or death. The premium is paid by the employer, but the expense of administering the insurance department is defrayed by the state. The amounts paid are based upon a percentage of the last yearly wages earned by the injured or deceased person. These benefits are paid so long as the disability, either partial or total, continues. The percentage varies in proportion to the severity of the injury. In case of death the widow gets 60 per cent. of the last annual wages for life, and each child under fifteen gets 15 per cent. until it reaches that age. The employer is not permitted to deduct the premium he pays from the employees wages, but he has, doubtless, long since anticipated the advice of President Roosevelt, added it to the cost of his product, and taxed it to the trade.

In Switzerland, while the government has not gone into the insurance business, it compels an employer of labor to take out accident insurance for his workmen, and the premium may not be deducted from their wages.

In Germany the government requires that all those manufacturers engaged in a certain line of production shall stand the entire risk of the injuries or death to employees engaged in any of the plants where those lines of manufacture is carried on. This risk must be insured against, and the insurer graduates the premium in proportion to the relative risks in the different plants. Thus all workmen are insured. For all total permanent disability two-thirds of the last annual earnings are paid for life, and proportionately less for partial temporary or partial permanent disability. In case of death 60 per cent. of the annual wages go to the widow for life, and 20 per cent. to the children during minority.

In France there is a fixed scale of price to be paid, but insurance against those risks is optional with the employer. The Government enjoins: First, the payment of all medical and funeral expenses. Second, commencing with the fifth day after the accident for temporary incapacity, one-half wages during the time of his disability. Third, for a total permanent disability, two-thirds of the annual wages for life, and proportionately less for partial, permanent or temporary disability. In case of death two-thirds of the annual wages go to the widow, and 15 per cent. to minor children during minority. Against the risks the employer in France protects himself, either by ordinary indemnifying insurance, or by mutual protective insurance associations organized among the employers, or by insurance in the Government National Accident Insurance Bank. The premiums may not be deducted from the wages, but are undoubtedly added to the price of the article, and most cases collected from American tourists, who, in turn, become smugglers with more or less success.

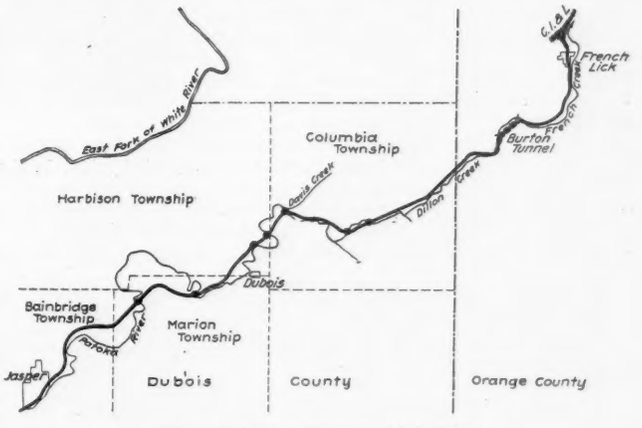
In Great Britain, since 1887, payment is compulsory, on railroads, factories, mines, quarries or engineering works. In case of death, not more than the last three years' annual earnings shall be paid to the widow or dependent family, and in no event shall an amount be paid exceeding three hundred pounds and proportionately less if the family be not dependent. In case of permanent or partial disability, from 50 per cent. of the annual earnings down, but in no case to exceed one pound per week.

For obvious and sound reasons the application of such a system to the industrial conditions of the United States would be attended by extreme difficulty, if indeed its adoption be at all possible or desirable. In the first place, the Federal government is absolutely without authority to enact or enforce laws of that character. As we have seen, the employer's liability act of the last Congress, even though limited in its operation to railroad companies engaged in interstate commerce, met with disaster in the first United States Court which tested the authority of Congress to enact it.

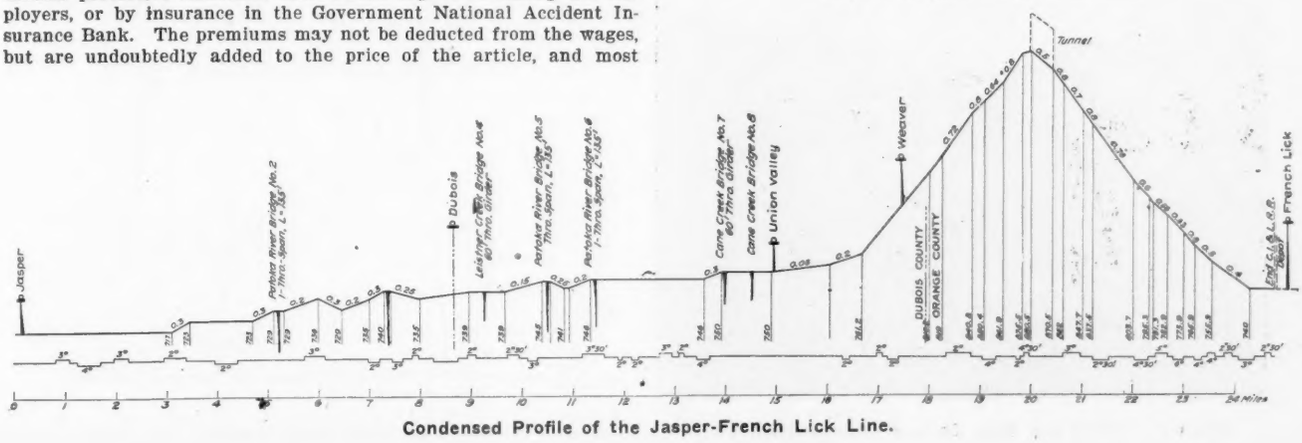
The individual states alone may legislate the subject within their own territorial limits. We have already noted the vast difference, the utter contrariety of existing laws upon this subject in the various states of this Union; the diverse theories and principles which obtain in different localities. What reasonable ground for expectation have we that all the states would ever agree to fasten a general liability upon all employers of labor? A system which to some of them may appear beneficent, to others is most repugnant. If by a wild flight of fancy we can imagine that all the states would agree to such a law, who so rash as to venture to suggest the adoption by all of a uniform, limited, reasonable and moderate scale of payments and indemnities in case of injury or death, such as the nations of Europe administer with humane results, for their people? What state legislature so deaf to the unthinking clamor of the multitude, so blind to its own political fortune, as to stand against extortionate demands for high and ruinous rates of compensation?

The Southern's New Line from Jasper, Ind., to French Lick.

The St. Louis-Louisville lines of the Southern Railway have a short branch running south from Huntingburg, Ind., to the Boonville coal field, with spurs to three different points on the Ohio river, one of which is Evansville. There is also a seven-mile spur north from Huntingburg to Jasper. Practically all of the coal now produced by this field is taken north by the Southern for delivery



Map of Jasper-French Lick Line.



Condensed Profile of the Jasper-French Lick Line.

by its main line either at Louisville or St. Louis. To reach the Chicago market it must either go north over the Chicago, Indianapolis & Louisville (Monon) from New Albany, Ind. (opposite Louisville), or over the Evansville & Terre Haute and Chicago & Eastern Illinois from Princeton, Ind., the junction point with the Southern. It has thus been unable to compete in the Chicago market with coal fields having a direct outlet and as a result has been largely shut out from the most desirable and profitable market of the Central West. The establishment of a direct line of transportation to Chicago would mean not only the development of this particular field, with the resulting augmented tonnage to be hauled, but also it would doubtless mean stimulated output and increased tonnage from all southern Indiana coal districts served by the Southern not now directly connected with the Chicago market.

The spur north from Huntingburg to Jasper has been mentioned. The Monon has a branch line 18 miles long running from Orleans, on its main line between Chicago and Louisville, southwesterly to French Lick Springs, a watering place of some prominence and distant from Jasper only 19 miles by air line. A connecting line between these two points would therefore supply the necessary link in the desired direct route. But the intervening country is quite rugged, making the construction difficult and costly. The traffic possibilities, however, appeared to justify the expenditure and work was begun on such a line by the Southern in the fall of 1905.

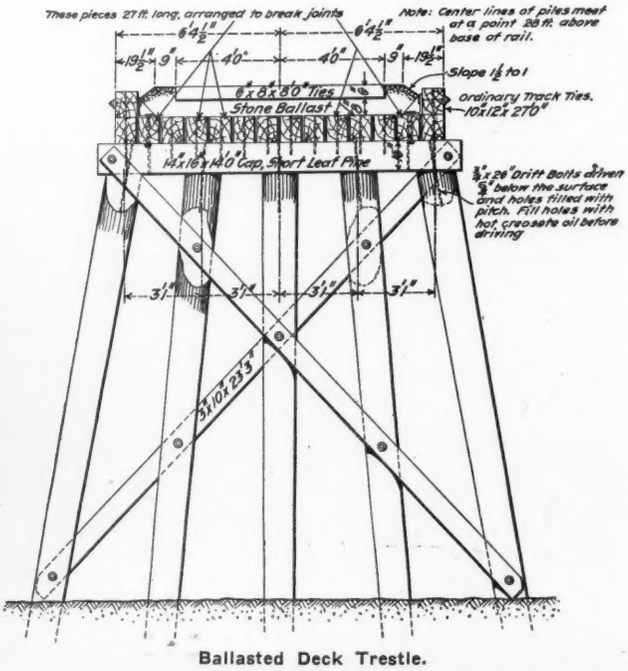
The length of the new line is 24.8 miles. As indicated by the accompanying map, from Jasper it takes the general direction of the Patoka river, which it crosses four times, to Dillon creek, which it follows closely to French Lick. The maximum gradient is 0.8 per cent., compensated, and the maximum curve 6 deg.; there is only one of these, however, also one of 5 deg., and a few of 4½ and 4 degs. The curves are mostly 3 deg. and under. As the profile shows, the highest point on the line is at mile-post 20, which is 157.5 ft. higher than Jasper. There is a tunnel at this point 2,200 ft. long, and the maximum gradient of 0.8 per cent. occurs only at the approaches to this tunnel. The controlling gradient elsewhere is only 0.4 per cent., and this will be the rating gradient of the line, the intention being to double the trains over the heavier summit grades and through the tunnel. For this purpose, passing tracks are provided at suitable points on each side of the tunnel.

The line was to have been ready for traffic by April 1 last, but unusually heavy and continued rains caused repeated slides in the larger cuts and fills that delayed the work six months at least. The most prominent example of the difficulties which have attended the work, due to the extremely wet weather, is at "big cut," 8.5 miles from Jasper. The original estimate was for 50,000 yds. of material, rated 80 per cent. rock. The rock, however, proved to be stratified throughout with soapstone, and the ground being surcharged with water, slide after slide has occurred until the total amount of material which will finally be removed will be at least four times the original estimate. This cut proved to be the critical point in the work, as tracklaying had, of course, to be done from the Jasper end of the line, and although most of the grading had been finished, the condition of the big cut prevented getting materials through to lay track beyond. A photograph of this cut is reproduced herewith. However, it fails to give an adequate idea of the character and extent of the real conditions.

Method of Timber Framing Heading in Burton Tunnel.

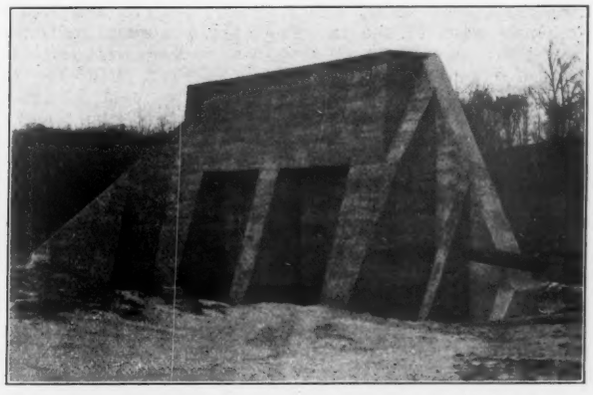
The tunnel is, of course, the most important single feature of the line. It is called Burton tunnel and, as already mentioned, is 2,200 ft. long. The four miles of line from French Lick to the tunnel were built prior to beginning work on same to enable machinery, supplies, etc., to be carried to it. The material pierced by

Big Cut, Where the Most Serious Sliding Occurred.



Ballasted Deck Trestle.

Jasper-French Lick Line of the Southern; Looking East from Station 40.



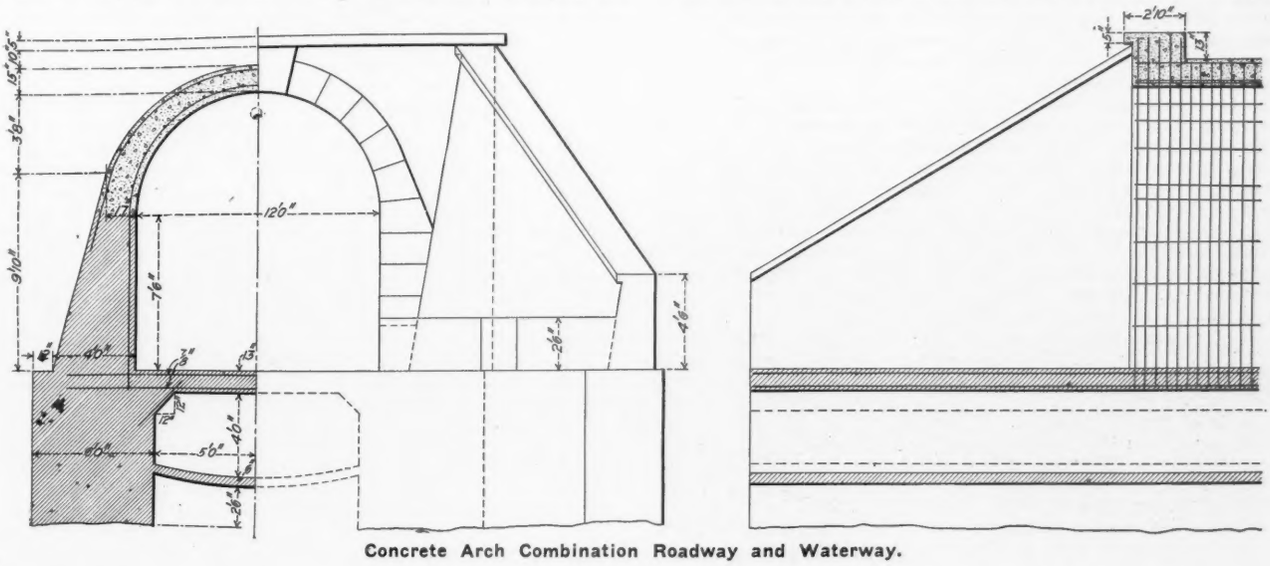
Rear View of Abutment; Potaka River Crossing.

the tunnel is shale, principally. The method used in driving the tunnel was that of taking out side and top drifts around a central core, which was afterward removed with a shovel. Sections of the tunnel are reproduced in the drawings. It is a single-track bore, the size of the opening through the natural material being 20 ft. wide by 26 ft. 3 in. high, and the clearance dimensions being 16 ft. and 21 ft. 6 in. respectively. The excavation of the material was closely followed by timber lining, as shown by the illustration. Inside the timber lining a reinforced concrete lining is now being placed, which includes a concrete bottom of unusual section. This bottom has parapets, 12 in. high, 6 in. wide at the top and 10 in. at the bottom, on each side of the rock ballast, and all drainage is cared for by the gutters between these parapets and the side walls. Weep holes of 3-in. vitrified tiling are provided every 20 ft. on each side. The side walls and arch of the concrete lining are reinforced with ¾-in. Johnson corrugated bars spaced as shown, the vertical bars extending horizontally into the bottom concrete 2 ft. 6 in. The quantity of material per lineal foot of lining is 4.132 cu. yds.

The approach to the south end of the tunnel is on a 4½ deg. curve. Also at this point there is a small creek which comes down the hillside from the west and crosses the right-of-way. Some thought was given to the best method to take care of this creek, and fluming it over the track was considered. But the objections to the presence of the overhead structure, and the cost of maintaining same, caused the idea to be given up in favor of conducting the water beneath the track and into a ditch along the east side of the tunnel approach cut. There are seven creek or river crossings on the line, four of which is Dubois, about 8¾ miles from Jasper. The profile shows of these are 135-ft. riveted through truss spans, and one 150-ft. The three creek crossings are 60-ft. through girder spans. The substructures for these crossings are reinforced concrete on pile foundations, and the superstructures are standard Southern designs for Cooper's E-50 loading. There are also a number of 20-ft. and 12-ft. reinforced concrete arches. These latter include a design of combined roadway and waterway, the drawings of which are included in the illustrations. In the particular design shown, a waterway 10 ft. wide and 4 ft. high at the center of the invert is provided immediately below the roadway, the 13-in. reinforced floor of the latter forming the roof to the waterway. The roadway entrances to the arch are protected on the waterway side by parapets 30 in. high and 26 in. thick. All of the concrete used on the work is a 1:3:5 mixture, and the reinforcing is Johnson corrugated bars. All trestles on the line have ballasted decks, the design being shown herewith.

Combination Roadway and Waterway Arch.

At French Lick a yard of 350 cars capacity, with the necessary



Concrete Arch Combination Roadway and Waterway.

terminal facilities, is being built, for joint use with the Monon. Also a new joint passenger station will be built. During the season there is a considerable passenger traffic to French Lick, hitherto reached only by way of the Monon branch already referred to and therefore most inconvenient of access from the west and southwest. This new line of the Southern makes this resort directly accessible from those regions.

There is at present only one town on the line between termini, which is Dubois, about 8¾ miles from Jasper. The profile shows two other stations: Union Valley at mile post 15, and Weaver, between mile posts 17 and 18. There are only small settlements at these points as yet. The line is to be rock-ballasted and when thoroughly settled will be laid with 80 or 85-lb. rails. The first rails are 60-lb. relaying. Treated ties are being used throughout, the timbers being red and black oak, beech, elm and gum, preserved with zinc chloride. All bridge timbers are creosoted.

The seven-mile line from Huntingburg to Jasper is being revised and rebuilt to correspond with the new line. The grade is being raised above the high-water level of December, 1906, the highest recorded since 1840. The grades are being reduced to 0.5 per cent. controlling, and the alinement changed at one point to reduce a 5 deg. curve to 3½ deg. A 135-ft. crossing of the Patoka river, built 25 years ago and therefore suited only for very light loads, is being replaced by one of the riveted through-truss E-50 designs used on the new line. Also a new frame station of neat design has been built at Jasper.

The average cost of the new line was about $40,000 a mile. The contract for the entire work from Jasper to French Lick was let to McArthur Brothers, Chicago, the working being done under the supervision of Edward Gray, Engineer Maintenance of Way of the St. Louis-Louisville lines. The concrete work was done by Bates & Rogers and G. H. Scribner, both of Chicago, one-half to each, except the tunnel lining, which is being done by the Cullen-Friestedt Company, Chicago. All of the concrete and bridge work was designed in Mr. Gray's office, and the steel work for the bridges was furnished by the Louisville Bridge & Iron Company.

The Strenuous Life of the Freight Agent.

The recent doubling of the rate to be paid for interchange freight cars, increasing the need of moving all foreign cars with the least possible delay, has led Mr. E. E. Betts, Car Service Agent of the Chicago & North-Western, to re-issue the per diem rules; and in connection with switching service and reclaims he says:

Switching service is the movement of a car to be loaded or unloaded, or the movement of a car between railroads, at a charge for the service rendered within designated switching limits, the road performing the service not participating in the freight rate.

It will be observed, therefore, that this campany pays 50 cents to the car owners for each day a per diem car is on our rails, whether in switching or road service. It is incumbent on this office to keep an absolutely correct record of all cars on our line in order that we may pay car owners what is due them, and *no more*. To do this we must have correct and legible interchange reports from agents at junction points. If one figure of a car number, or the initial, is wrong, it means sending out a correction to the agent to get it right, and this makes much additional work on our part and on the part of the agent. Bear in mind, please, that we have 40,000 individual car records daily, and if only 1 per cent. are wrongly reported it means 400 correction sheets and 400 replies. It takes much longer to correct than to report right in the first place. Then, again, we are likely to pay out money unnecessarily when cars are incorrectly reported, and it doesn't require many 50 cents to amount to considerable money, so let me urge on agents to see that their interchange reports are correct.

Where per diem cars are switched for connections, we pay the per diem to car owner and are entitled to reclaim from the line for whom switching is done an agreed number of days—in Chicago five, but usually in country three to four days. As day of receipt is not counted, it really gives us some additional time, depending on the hour of the day the car is received. If we handle the car in less than agreed time, we are ahead; if we take more than the agreed number of days, we lose, therefore promptness in placing, releasing and returning cars is profitable. To get the best results requires continual watchfulness. Agents should keep a pad constantly before them of all cars received for switching, showing date, and fill in the date of return. Keep this on the regular reclaim form, then you will know all the time how many cars you have in your possession. Bear in mind this fact: We are entitled to a reclaim on every per diem car we switch (system excepted), no matter what disposition is made of it after unloaded. If you are getting cars from connections faster than they can be placed account disability of consignee, your remedy is collection of demurrage. We cannot hold the bag —our switching revenue must be net revenue. The reclaim must equalize the per diem, at least, to effect this result.

A car day ends at midnight. There is a difference of 50 cents to our company between a delivery of a car effected at 11.59 p.m. and 12.01 a.m. All cars made empty each day, or cars loaded for connecting lines, must be switched out in preference and delivered before midnight, and where no night switch engine is worked, you must see that the day engine does this work at the latest hour possible, so as to get all available cars. If no engines are employed, have the way-freight engine to do it. If cars are set on transfer track after 6 p.m. and no receipt can be obtained, arrange with connecting line agent for a bill box, and cars are delivered when set on this track and billing deposited in designated place. Do not take empties unless order has been placed with you by the industry, and when you do take them, see that they are placed at once, and collect demurrage after expiration of free time. If you do not place the cars promptly, either loaded or empty, you are holding the bag instead of the other fellow. All we want is what is right, but cars are made to transport freight, not to stand idle, either to be loaded or unloaded, and the more promptly we handle the shipper's loads and unloads, the more cars there will be for those wanting them. If shippers could be made to realize this and act accordingly, it would increase the car supply in this country 15 per cent.

General Manager Smith to Be Tried for Manslaughter.

Justice Giegerich, of the Supreme Court of New York, has decided that Alfred H. Smith, general manager of the New York Central & Hudson River, must stand trial on his indictment for manslaughter in connection with the derailment of an electric train near Williamsbridge on February 16. Mr. Smith, through his attorneys, DeLancey Nicoll and John D. Lindsay, entered a demurrer, which was disallowed by Justice Giegerich, who says in his opinion:

On the day named the defendant was vice-president and general manager of the corporation, and as such officer he had charge and control over the maintenance of tracks, roadbeds, the curves and the operation of all trains over the line, and of the engineers running the engines.

And it was then and there the duty of the said Alfred H. Smith, as such officer and general manager, thus in charge of and control over the operation of the said trains and the employment and instruction of the said locomotive engineers, to ascertain and know at what speed it was safe for the said trains to pass along the said line of railroad and around the said curve, and to use and exercise and cause to be used and exercised all proper, reasonable and effective measures and all means within his power to prevent said train from passing along the line of railroad and around the curve at a speed faster than was safe for the train to pass, and to place the train under the government and control of a locomotive engineer properly trained and experienced and competent to run the train with safety along the line of railroad and around the said curve; but defendant, knowing the facts and his duty, as aforesaid, wholly omitted to ascertain at what speed it was safe for the train to pass around the curve, and placed the train under the control of a locomotive engineer not properly trained and not experienced and not competent to run the train with safety around said curve. It is further alleged that by reason of the culpable negligence of the defendant the train was run at a dangerous speed, and left the rails and was wrecked, thereby causing the death of one Clara L. Hudson, a passenger.

I am asked to take judicial notice of the obligations imposed upon the defendnt as general manager of the great railroad system of which he was in charge, and of the fact that by reason of their magnitude, the defendant could not have been charged with the personal performance of the duties the indictment alleges were imposed upon him. It is said that the court should not entertain the idea that it is ever one's personal duty to do that which is impossible for him to do personally. It is enough on this point to say that no such case is presented. It was not only possible for the defendant personally to cause proper measures to be taken for ascertaining what was a safe rate of speed around the curve in question and for providing proper regulations against running trains in excess of such speed, and for procuring trained and competent engineers, but it is manifest that in any properly conducted system of railroad administration such personal duty must have rested upon some one. Duties of supervision and management are just as much personal as are the manual duties of the least skilled employee of the road. If this particular duty, which the indictment avers was the defendant's, in fact belonged to some other officer of co-ordinate rank, or had been entrusted by the defendant to some carefully chosen and competent subordinate, so as to relieve him from further personal responsibility, these are facts that can be shown at the trial; but for the present purposes the allegations of the indictment must be taken as verities, and those allegations are that it was a part of the defendant's employment to perform the acts of supervision and management specified, which he in part failed to perform and in other respects improperly performed. That the death described in the indictment was a direct and immediate consequence of such acts and omissions is also sufficiently alleged.

Washing Out and Filling Boilers with Hot Water.

The essential feature of an economical system for heating water to be used in washing and filling boilers, embodies the principle of utilizing the heat contained in the water discharged for raising the temperature of the water to be used for washing and filling. Utilization of exhaust steam from various sources provides a means of maintaining the temperature of the water when locomotive boilers are not being blown off. A system operated according to this principle requires a battery of heaters located at some convenient point in or near the roundhouse, where the heat contained in the water and steam blown off may be utilized in heating the water used for washing and filling. The heaters are connected by suitable permanent mains and adjustable connections with the locomotive boiler blow-off cocks in order that all water and steam blown off will be delivered to the heater. The heat so utilized is supplemented by delivering waste steam from the exhaust of stationary engines and air compressors. The economical feature of this system is that heat which would otherwise be wasted is utilized to good advantage and the water for washing and filling is heated at an extremely low cost. Where it is necessary to obtain live steam from a boiler to operate the heaters, the economical feature of the system is destroyed.

To wash a maximum number of boilers two pipe lines are necessary between the heaters and the blow-off connections at the boiler. One pipe is for blowing to the cistern and the other is for delivering hot water to the boiler during the process of cooling after the steam has been blown off. Such an arrangement establishes a pressure in the boiler and discharges the water more rapidly than it would escape by gravity alone, because of the frictional resistance of the pipes. It is considered undesirable to blow water and steam from the boiler at the same time and allow scale and mud to stand on the hot metal without being covered by water. For this reason water should not be let out of the boiler until the temperature of the metal is the same as the temperature of the water that will be used for washing.

Heating systems may be so arranged that the heat of the steam released when the boiler is blown off may be used to heat the water for both filling and washing, or the boiler may be washed out with the water originally drawn from the boiler and the filling water alone heated by the steam blown off. Where the shop power house is equipped with condensing engines, the hot water from the condensers may be led to a pool or cistern and delivered to the roundhouse for washing boilers. Another method of providing hot water for washing is to deliver all water blown out of the boilers to a receptacle where it is allowed to settle, the same water being used many times. Arrangements are necessarily made to dispose of the scale and sludge that settle in the bottom of the receptacle.

A suggested method is to pipe the roundhouse with water and steam connectors at each pit and provide a portable injector to be carried from one engine to another.

When cold water is used for washing and filling boilers about seven or eight hours are usually consumed to blow off, wash out, fill up and raise steam to 100 lbs. pressure. To perform the work in less time is apt to cause detrimental results to the boiler. Where hot water is used for washing out and filling, a boiler can be blown off from 150 lbs. pressure in 20 minutes. It may be washed almost immediately with hot water and by filling with water at a temperature of 212 deg. F., a pressure of 100 lbs. may be raised in 30 minutes from the time the fire is started. The actual time consumed at the point from which these figures are quoted is usually about three hours for blowing off, washing out, filling up and raising steam. Boilers have been washed out at this point in less than two hours and there are other instances on record of equally short time. It is believed, however, that two hours will hardly represent general or regular practice.

While opinions vary as to the time actually saved by washing and filling boilers with hot water, it is generally considered that an engine will be ready for service in at least one-half of the time usually required when washing and filling with cold water.

The actual cash saving to be obtained by utilizing the heat in the water blown off depends upon a number of variable factors and can hardly be determined with any degree of accuracy, inasmuch as the same figures would not apply to all cases. Several authorities consider that a saving of 50 per cent. is effected; another advises 33 per cent.; a representative of one road says, side-sheets 75 per cent., flues and stay-bolts 50 per cent.; another believes that an average of $1 per boiler is saved.

The actual economy obtained depends, among other things, upon the size of the boiler, the amount of heat in the steam blown off, the initial temperature of the water to be used for washing, the size of grate, as well as the heating value and the price of the fuel used. The results of some experiments showed that locomotives with a grate surface of 54 sq. ft. could be fired up with about 1,200 lbs. of coal when the boiler was filled with hot water, and a good fire was left on the grate. To fire the same engine when the boiler was filled with cold water required from 2,200 to 2,400 lbs. of coal.

With a locomotive having 72 sq. ft. of grate area, 1,600 lbs. of coal were required to fire up when the boiler was filled with hot water, the greater amount of coal used, as compared to the grate of 54 sq. ft., being due to the difference in size of grates. When the boilers were filled with cold water there was very little difference in the amount of coal used on the two grates.

At a certain locomotive terminal where 95 boilers are washed per month the cost of labor and fuel for each boiler washed is as follows:

Seven hours' labor, one man, at 18 cents per hour	$1.26
1,500 lbs. coal for building fire, at $2 per ton	1.50
200 lbs. coal for pumping about 6,000 gals. water to cool boiler	.20
Total	$2.96

With a system of hot water washing investigated by those in charge of this terminal three hours per boiler washed was considered a conservative estimate. The corresponding cost per boiler washed with the hot water system would be:

Three hours' labor, one man, at 18 cts. per hour	$0.54
900 lbs. coal for building fire, at $2 per ton	.90
Total	$1.44

According to these figures, the saving in labor and fuel for each boiler washing would be $1.52. Washing 95 boilers per month would represent a saving of $144.40 per month, or $1,732.80 per year. Estimating the cost of installing the necessary equipment for a hot water system to be $9,000, the figures quoted would represent an interest of 19 per cent. on the original investment.

A further economy represented by the hot water system is in the shorter terminal detention. The earning capacity of a locomotive is realized when it is on the road and not when it is in the roundhouse undergoing repairs.

The figures quoted show that an engine may be ready for service in four hours' less time when washed with hot water than when cold water is depended upon. Assuming the average engine mileage to be 10 m.p.h., the time saved would represent 40 engine miles, and at, say, 960 tons per train, the four hours' additional service of each engine would represent 38,400 ton miles. The 95 engines washed per month would then enable the road to obtain 3,648,000 more ton miles per month from engines cared for at the terminal under consideration. In busy seasons this additional ton mileage would represent considerable economy.

The number of boilers which should be washed per day to justify installing a hot water washing system would depend on the peculiar local governing conditions and the interest that would be represented by the investment. On the other hand the elaborateness of the plant might well vary with the amount of work to be done. For instance, if but very little boiler washing is done at a roundhouse, the use of a portable injector would seem practical, for it is more than likely that there is a boiler in the roundhouse for operating the washout pump, even if there are but five or six stalls in the house.

The results obtained by the hot water system of washing and filling boilers indicate that not only is much time saved in turning engines at terminals, but repairs to boiler in engine house and back shop are reduced by this method of caring for boilers. In bad water districts, the use of treated water in connection with the hot water system of washing and filling, results very successfully in lengthening the life of tubes and fire-boxes.

A representative from a Western road advises that before the installation of a hot water system in 1903, tubes were removed from freight engines every 10,000 miles and from passenger engines after 15,000 miles' service. Since this system has been in operation the mileage of the tubes has been doubled. A representative of a road that has had a hot water system in operation 15 months advises that engine failures due to leaking tubes and side-sheets have decreased 50 per cent. and that repairs for boiler work have decreased 22 per cent. Another representative says that before three hot water plants were put in operation on a division, the heavy power in freight service made 30,000 miles between flue settings. The same power is now making 50,000 to 60,000 miles, using the same feed water as formerly.—*From a committee report to the convention of the Traveling Engineers' Association.*

According to a press despatch from St. Petersburg the director of the Transcaucasian Railway, Colonel Neigebauer, has issued an order containing the announcement that in six months of the current year 30 officers of the Transcaucasian line have perished by violent death. Ten among them were of the highest rank. It has become customary to ascribe these appalling murders to revolutionary organizations, but it is believed that a majority have been caused by a desire to see situations vacant. Therefore the Director has ordered that all vacancies which have resulted from officials having suffered violent death shall be filled by persons transferred from the railroads in European Russia, and none by promotion of local candidates.

Reduced Passenger Rates in Georgia.

The order of the Georgia Railroad Commission reducing passenger rates, in effect Sept. 2, must be obeyed by every road in the state, or the officers of the road disregarding it will be indicted and prosecuted by Gov. Hoke Smith. This, according to the newspapers, is the Governor's threat. He has notified all judges and prosecuting officers in the state to watch for violations of the law and to prosecute. Up to this week the roads have been unable to get a Federal injunction. The Atlantic Coast Line, the Central of Georgia and the Atlanta & West Point went before United States Judge Shelby at Huntsville, Ala., and asked for an injunction, but the Judge refused to grant it. The Judge, however, ordered the Georgia commission to appear on Sept. 16 in Atlanta before some United States Circuit Judge to show cause why an injunction should not be granted. In refusing the restraining order Judge Shelby commented sharply on the action of the railroads in waiting until two days, one of them on Sunday, before an order was to take effect to ask an injunction, although the order reducing rates was made three months ago.

Judge Shelby holds that there is no presumption to begin with, that the commission has not acted in good faith, and that the order reducing rates is confiscatory. "I cannot hold," says Judge Shelby, "that the affidavit to the bill filed by the railroads outweighs the prima facie presumption that the action of the Georgia Railroad Commission is valid."

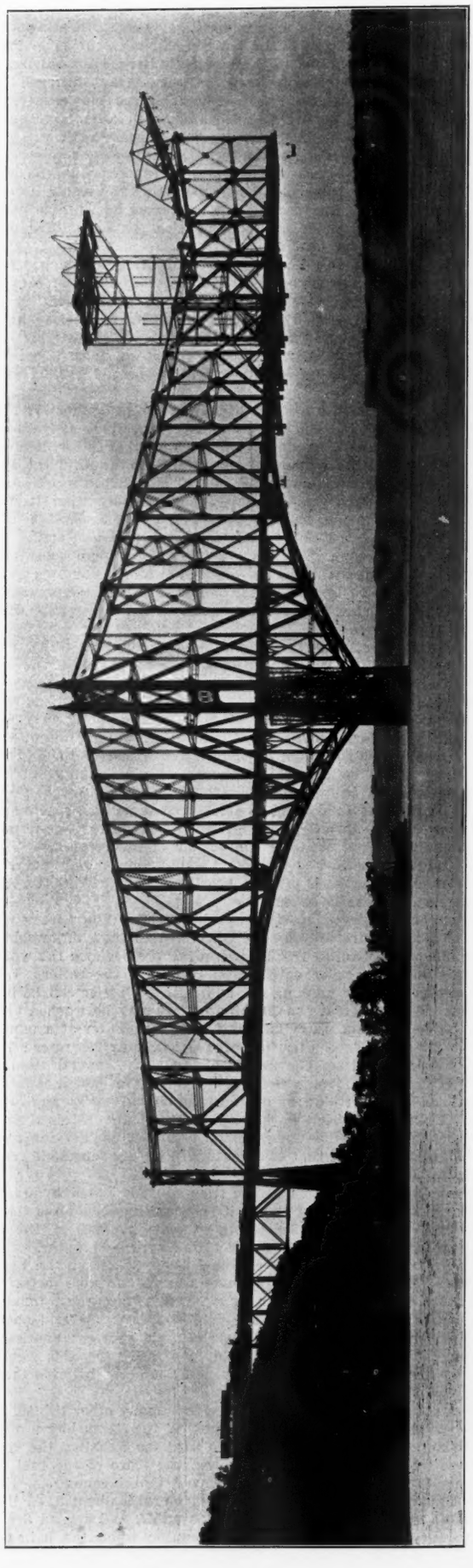
Collapse of the Quebec Bridge.

The south half of the Quebec bridge, which was being erected over the St. Lawrence river, collapsed on the afternoon of August 29, about half-past five. Of the 92 men who were working on the bridge at the time, 84 were killed or drowned and only eight were rescued, all of whom were injured. The entire structure fell and nothing was left standing except the approach span, which was carried on separate supports on the shore side of the anchorage. The south cantilever span had been erected and permanent riveting was nearly completed. Three panels of the suspended span over the middle of the river were in place and partially riveted up, and the erection of the fourth panel was in progress when the bridge fell.

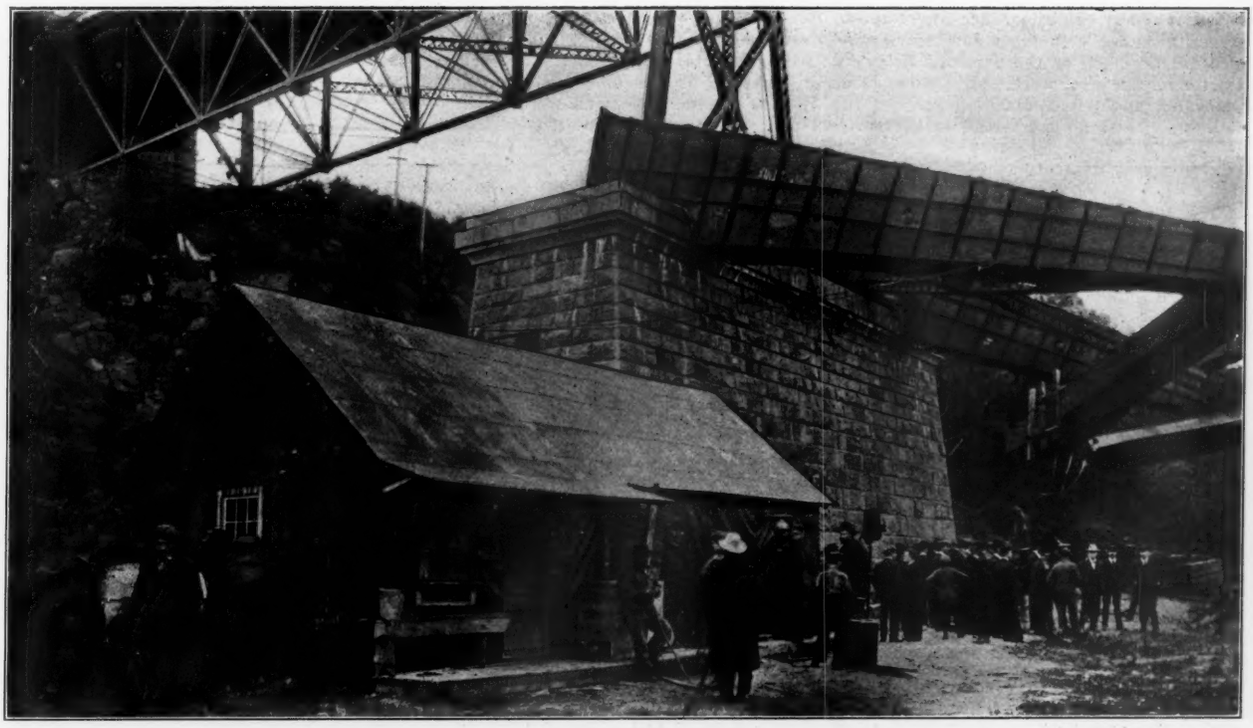
While the exact cause of the failure has not been determined as we go to press, E. A. Hoare, Chief Engineer of the Quebec Bridge & Railway Co., the owners of the bridge, is reported to have said that the failure apparently took place near the main post, and that the collapse was vertical. The accompanying photographs of the wreckage, which are reproduced through the courtesy of *La Presse*, of Montreal, seem to substantiate the theory of vertical failure. The wreckage of the main posts is scattered on both sides of the pier and the other parts are almost directly underneath their former position in the structure. The anchorage supports are bent down toward the main pier, but the anchor eye-bars are intact in the foundations, indicating that the failure was not due to overloading and consequent overturning of the cantilever span. Nearly 15,000 tons of steel fell, and the principal members, which were the largest ever fabricated, are twisted, bent and broken so as to be hardly recognizable. The masonry of the main and anchorage piers seems to be but little damaged.

At the time the bridge fell there was a wind blowing about 28 miles an hour and a train of cars loaded with steel was being pushed out to the traveler at the end of the span. The engineer of the locomotive was carried down with the wreckage, but was rescued alive from the water by a boat which had just passed under the bridge. There were two travelers being used for the erection, which were both near the outer end of the span. The main traveler was about at the end of the cantilever span and the second traveler, running on the top chord of the truss span, was out over the third panel. While the weight of the two travelers and of the material piled near the end of the bridge was considerable, it was not more than the weight of the two remaining panels of the center span yet to be erected, and of the floor system of the entire half span which had not been put in place. It is not probable, therefore, the failure was due to excessive dead loads which had not been allowed for in figuring the erection stresses. If the failure was due to defective design, the error must be attributed to wrong assumptions or calculations of stress and not to insufficient loading.

While the failure came suddenly and without warning to the men on the bridge, who had no opportunity to escape, it is unfortunately true that the engineers in charge of the work had a warning that everything was not right, but the danger was not appreciated until it was too late. Early in the week one of the workmen on the bridge discovered and reported to the resident engineer, A. H. Birks, that one of the lower chord members in the third panel out from the main post was slightly buckled. N. R. McLure, inspector on the bridge for Theodore Cooper, who is consulting



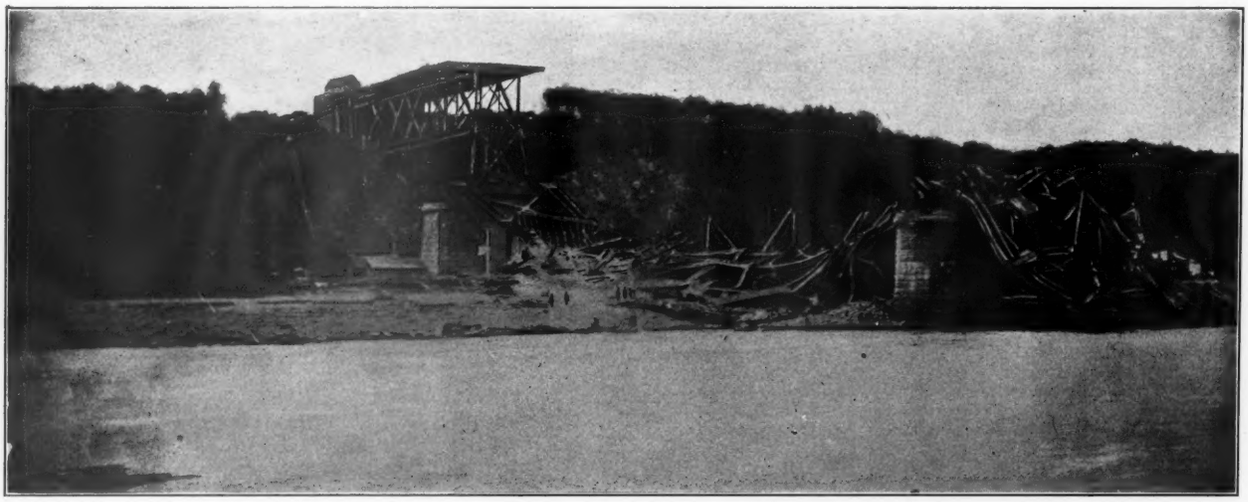
The Quebec Bridge as it Appeared on August 15, Two Weeks Before the Collapse.



Anchor Pier, Showing Anchor Arm Supports Still Fast to the Masonry.

General View of the Fallen Bridge from the South Bank of the River.

engineer for the Quebec Bridge & Railway Co., was notified, and on Wednesday he left the bridge site and came to New York, arriving Thursday morning with his report, a copy of which had been forwarded to the office of the Phoenix Bridge Co., Philadelphia, the contractor for the steel work. Mr. Cooper received the report Thursday morning and immediately telegraphed the Phoenix Bridge Co. as follows: "Add no more load to bridge until full investigation is made. See report of McLure." This telegram was delayed and was not forwarded from New York until 12.15 p. m. It was received by the Phoenix Bridge Co. early in the afternoon and was put on the desk of Mr. Deans, Chief Engineer, who was not at his office. Mr. Deans returned about 5 p. m., and before he could telegraph ordering the men off the bridge it collapsed.



View of the Wreckage from the River, Showing Approach Span Left Standing.

The Canadian Government has appointed Henry Holgate, Montreal; J. G. Kerry, Montreal, and Professor Galbraith, of Toronto University, to investigate the collapse and to determine, if possible, the cause. The loss is estimated at between $1,000,000 and $1,500,000, and two or three years' delay in completing the bridge. Work on the north half had only progressed to the point of erecting the false work to support the shore arm of the north cantilever span. Much of the material for the north half of the bridge is on the ground, and work will probably be resumed next year. The river channel was not seriously obstructed by the wreckage and is open for navigation.

Near View of Wreckage Inside of Main Pier.

The Quebec Bridge & Railway Co. was chartered as the Quebec Bridge Co. in 1887 to build a highway and railroad bridge over the St. Lawrence river about seven miles above Quebec, to connect the railroads on the north and south shores of the river. It was granted a subsidy of $1,000,000 by the Dominion Government, $250,000 by the Province of Quebec, and $300,000 by the City of Quebec. The bridge was intended to be used by the Grand Trunk and the Intercolonial for an entrance into Quebec. Competitive plans were asked for in 1897, and in 1898 the Dominion Railway Committee approved the plan for a cantilever bridge with a channel span of 1,800 ft., the longest in the world. Bids were opened in 1899, and the contract for the piers and abutments was let to M. P. Davis in 1900. The corner stone was laid on October 2 of that year. The Phoenix Bridge Co., Philadelphia, Pa., was awarded the contract for the steel superstructure. The substructure was completed in November, 1902, and during the seasons of 1902 and 1903 the 210 ft. deck truss approach spans at each end of the bridge were erected by the Phoenix Bridge Co. The Quebec Bridge Co. was reorganized under the present name in 1903, and under an arrangement with the Dominion Government, which required the use of the bridge for a connecting link in the proposed Grand Trunk Pacific, the government guaranteed the bonds of the new company to the amount of $6,678,200. Work on the erection of the south half of the main structure was not begun until July, 1905. At the end of the working season, December 1, six panels of the anchor arm of the cantilever had been erected on falsework. During the season of 1906 the entire cantilever was erected and the falsework removed under the anchor arm. Erection had progressed to the fourth panel of the suspended truss during the present season.

The total length of the bridge between abutments is 3,220 ft., and it consists of two deck truss approach spans 210 ft. long, two

anchor arms each 500 ft. long, two cantilever arms each 562½ ft. long, and one suspended truss span 675 ft. long, the longest simple truss span built. The distance from center to center of main piers is 1,800 ft. The trusses are pin-connected and are spaced 67 ft. apart center to center. They vary in depth from 97 ft. at the portals to 315 ft. over the main piers. The main posts rise 400 ft. above the river and there is 150 ft. clear headway under the central span at high tide. The bridge was to have carried two railroad and two street car tracks, two roadways and two footwalks, all on the same level. The total weight of steel required was 38,500 tons. The main piers are concrete faced with granite, and each contains 35,000 cu. yds. of masonry. They are 30 ft. by 130 ft. at the top.

All of the detail plans for the superstructure were made by the Phoenix Bridge Co. and approved by E. A. Hoare, Chief Engineer of the Quebec Bridge & Railway Co., and by Theodore Cooper, Consulting Engineer for the Dominion Government and the Quebec Bridge and Railway Co.

The officers of the Phoenix Bridge Co. are: David Reeves, President; John S. Deans, Chief Engineer; P. L. Szlapka, Designing Engineer; A. B. Milliken, Superintendent of Erection, and A. H. Birks, Resident Engineer.

The officers of the Quebec Bridge & Railway Co. are: S. N. Parent, President; Ulric Barthe, Secretary; E. A. Hoare, Chief Engineer, and Theodore Cooper, Consulting Engineer.

Compound Ten-Wheel Locomotives for the Buenos Ayres Western Railway.

The Baldwin Locomotive Works has recently built five compound 10-wheel locomotives for the Buenos Ayres Western Railway. They were built throughout to drawings furnished by the railroad and have many special features.

As shown in the photograph, these engines are outside connected with slightly inclined cylinders. They are cross compounds, with the high-pressure cylinder on the left side and the low-pressure on the right side. The intercepting valve is placed on the left side above the high-pressure cylinder. It is of the piston valve type, as patented by Von Borries, and is worked in connection with the reversing gear. The receiver pipe between the high and low-pressure cylinders is copper, and is located in the smokebox. The slide valves are of bronze, and are balanced; they travel horizontally over vertical seats, the steam chests being placed between the engine frames. With this arrangement, a simple form of Stephenson link motion is readily employed. The eccentrics are placed on the second driving axle, while the links are suspended by double hangers immediately back of the first driving axle. The link blocks are connected to the valve stems by short transmission bars which pass over the leading driving axle. A suitable cross-tie, bolted to the frames, supports the valve-rod guides. Thus all parts of the motion are practically in the same plane, and the tendency for the gear to twist and spring is reduced to a minimum. The reversing mechanism is of the screw type.

The guides are of steel of the two-bar type, while the crossheads are of cast steel, with cast iron shoes lined with anti-friction metal. The piston rods are extended through the front cylinder heads; the pistons are of cast steel, with cast iron packing rings. All the driving wheels have cast steel centers, with tires held in place by shrinkage, retaining rings and set screws. The leading driving wheels have blank tires.

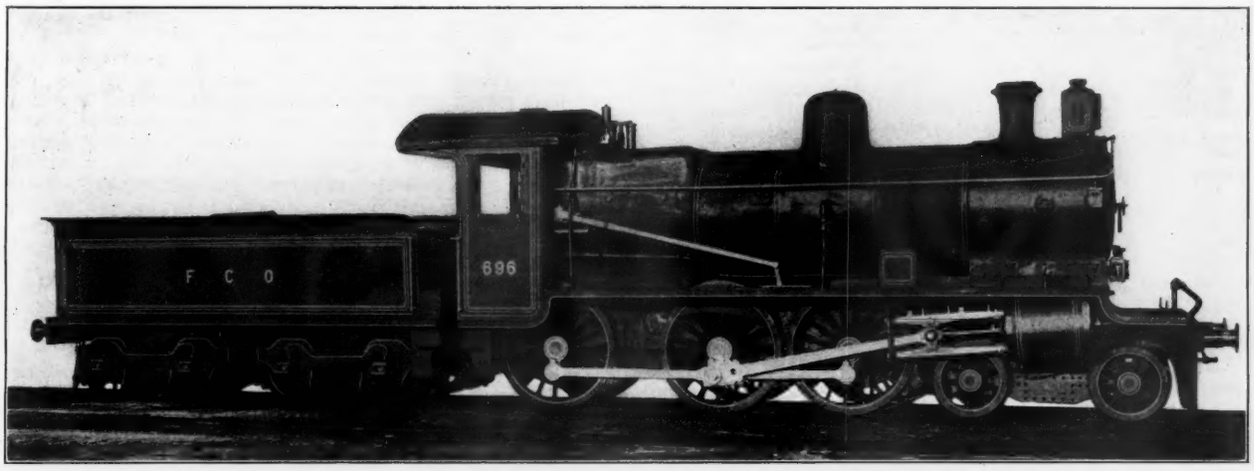
The frames are of the plate form, 1⅛ in. thick, and planed on both sides. The "horn blocks," or pedestals, are of cast steel, with wedge adjustments. All the driving springs are underhung, and the driving wheel loads are equalized. The leading truck is of the swing-link type, designed to swing 1¾ in. on each side of the center line. The truck wheels are steel tired, with cast steel centers.

The boiler is steel, with the exception of the sides, back and crown of the firebox, which are copper. The firebox tube sheet is steel. The Belpaire system of staying is used, and the staybolts are bronze, with the exception of those in the throat and crown, which are Yorkshire iron. The throat sheet completely encircles the barrel, to which it is united by a double row of rivets. An oval fire door opening is used, and it is formed with a wrought iron ring machined on both sides, to which the inside and outside sheets are riveted. The boiler barrel is built up of three rings. The circumferential seams are double riveted, while the longitudinal seams are butt jointed, with double covering strips and six rows of rivets. As is usual in British locomotive practice, the smokebox is separate from the boiler shell, to which it is united by a ring riveted to the barrel. The sides of the smokebox are fitted and bolted at the bottom, to the engine frames.

Among the boiler fittings may be mentioned two safety valves of the "Ramsbottom" type, which are mounted over the firebox; also two water gages which are placed in the cab. No gagecocks are applied. The grate, which slopes toward the front, is made up of plain bars of wrought iron. The boiler is fed by two injectors, one on each side, and also by one pump, which is driven from the left hand crosshead.

The engine is provided with steam brake equipment on the driving wheels, in addition to the vacuum brake for the tender and train. The sandboxes are placed on the runningboards, and steam sanding equipment is applied. The couplings are of the screw type, with draw hooks and spring buffers.

The tender is carried on two four-wheeled trucks of the swing link type, having steel-tired wheels with cast steel spoke centers. The frame is built of steel plates and angles. The tank has a water bottom and is of 4,200 gallons capacity. These locomotives will be used in both freight and passenger service.



Compound Passenger and Freight Locomotive for the Buenos Ayres Western Railway.

The following are some of the principal dimensions of the engines:

Gage	5 ft. 6 in.
Cylinders, diameter, h. p.	19 "
Cylinders, diameter, l. p.	27½ "
Piston stroke	26 "
Boiler material	Steel
" diameter	62 in.
" thickness of sheets	11-16 in.
Fuel	Coal
Steam pressure	200 lbs.
Firebox, material	Copper
" length	80 11/16 in.
" width	44⅝ "
" depth, front	74⅝ "
" depth back	60⅝ "
" thickness all sheets	½ in.
" material of tube sheet	Steel
" water space	3 in.
Tubes, material	Iron
" number	241
" diameter	1⅞ in.
" length	12 ft. 9⅛ "
Heating surface, firebox	132 sq. ft.
" " tubes	1,495 "
" " total	1,627 "
Grate area	25 "
Wheels, diameter, driving	68 in.
" " truck	38 "
" " tender	41 "
Journals, driving	7¾ in. x 9 "
" trucks	6 " x 10 "
" tender	5¼ " x 9 "
Wheel base, driving	13 ft. 7 "
" " total engines	25 " 3½ "
" " engine and tender	48 " 6 "
Weight on drivers	104,600 lbs.
" on truck	42,300 "

Weight, total engine	146,900 lbs.
" engine and tender	242,000 "
Tank capacity, water	4,200 gals.
Tank capacity, coal	220 cu. ft.
Tractive power	18,370 lbs.
Ratio of high to low pressure cylinder	1 to 2.09

$$\frac{\text{Weight on drivers}}{\text{Tractive power}} = 5.69$$

$$\frac{\text{Total weight}}{\text{Tractive power}} = 8.0$$

$$\frac{\text{Tractive power x diameter drivers}}{\text{Heating surface}} = 767.77$$

$$\frac{\text{Heating surface}}{\text{Grate area}} = 65.08$$

$$\frac{\text{Firebox heating surface}}{\text{Total heating surface}} = 8.11 \text{ per ct.}$$

$$\frac{\text{Total weight}}{\text{Heating surface}} = 90.29$$

Volume h. p. cylinder x 2 = 8.53 cu. ft.

$$\frac{\text{Heating surface}}{\text{2 x Vol. h. p. cylinder}} = 190.73$$

$$\frac{\text{Grate area}}{\text{2 x Vol. h. p. cylinder}} = 2.93$$

Tube heating surface equated to firebox heating surface (Vaughan formula)	418.71 sq. ft.
Total equated firebox heating surface	540.71 "
Ratio equated heating surface to total heating surface	1 to 3.00

Enginemen and Superheaters.

The engineman has his little part to play to accomplish the successful operation of the superheater and obtain from it the highest possible efficiency. While the engine is working, conditions permitting, the circulating tubes should be kept full of steam at boiler pressure, and to do this the engine should be worked with a full throttle and the cut-off regulated accordingly. While the effect of the superheater's work is to dry the steam on its way to the steam chests, it is just as essential and desirable that a reasonably low water level be carried in the boiler with the superheater as it is in the case of an engine using saturated steam. The engineer must see to it that the superheater damper is working properly at all times. The damper might stick in the closed position, in which case the superheater is useless and the total heating surface of the engine materially reduced, or the damper might stick in the open position, in which case there will be a deterioration of the superheater tubes, resulting in their finally breaking and causing an engine failure. Engines have been known to run for a month or more without a damper, and this, as well as other evidences, leads to the opinion that burning cinders in the smoke-tubes are partly responsible for the overheating and blistering of the return bends and the firebox ends of the circulating tubes; but be this as it may, it is essential that the engineer watch the damper and report it when it fails to work.—*From a committee report to the Traveling Engineers' Association.*

New Railroad Law in Georgia.

The Georgia Legislature, now in session, has passed the Candler-Overstreet bill, enlarging the State Railroad Commission from three to five members, and making radical amendments to the general railroad law of the state. The names of the members of the Commission as reorganized are given in another column. The Governor makes appointments to fill out the board, but with the next election the members will be elected as heretofore, and the term of each will be six years. The Commission will henceforth have supervision over telegraphs, telephones, street railroads, heat, light and power companies, docks, wharves and cotton compress corporations. The qualification for commissioner is to be 30 years of age, a qualified elector, and to be free from any interest in the businesses which the board is to control; "and a candidate is eligible without reference to his experience in law or in railroad business." We summarize the other principal features of the law.

Section 4. The Commission may employ two or more rate experts at a cost of not over $4,000 yearly in the aggregate.

Section 5. The power to determine what are just and reasonable rates and charges is vested exclusively in the said Commission.

Section 6 describes the powers of the Commission. It may investigate of its own motion, and may require common carriers and other public service corporations to establish and maintain reasonable service and facilities. It may require publication of time tables in local newspapers; may prescribe uniform accounting, the same to be, as far as practicable, in conformity with the regulations of the Interstate Commerce Commission.

Section 7. The Board is authorized to ascertain the cost of construction and the present value of corporation properties in Georgia; to require the construction of side tracks, and compel service on private sidings; to compel the operation of sufficient passenger service; to order the making and operation of physical connections between railroads at junctions; to prescribe penalties regarding the prompt movement of freight and rules for the transfer of cars through yards; to order the erection of stations and to regulate schedules of trains at junction points.

Section 8. Each corporation must furnish to the Commission a list of its stocks and bonds, and no corporation shall issue obligations for more than one year without the approval of the Commission, and then only so far as necessary for actual and reasonable expenditures. The decision of the Commission is to be final as to the validity of securities issued. Notes issued for one year or less shall not be refunded by long time obligations without the consent of the Commission.

Section 9. Penalties. A corporation violating this law shall be liable for all loss, damage or injury caused thereby; and if the violation of law is found by a jury to be wilful, the offender must pay a reasonable counsel's fee.

Section 10 prescribes the procedure for the enforcement of penalties.

Section 11 repeals sections 3 and 4 of the law of August 23, 1905, which gave the Commission power to regulate the transportation of freight, the present law taking the place of that.

Section 12 prescribes a penalty of $5,000 for violation of this act. Prosecutions for the recovery of penalties are to be brought in the name of the state of Georgia by direction of the Governor, and suits are to be given precedence in the Court over other business. The court shall not be adjourned until the suit is legally continued or is disposed of.

Section 13 makes it a misdemeanor to violate or aid or abet in violating this law, and any officer or agent found guilty shall be punished according to Section 1039 of the Penal Code of 1905; and besides this he shall be subject to indictment in any county where a subordinate employee by his approval violates either the law or the directions of the Commission.

Section 14 fixes the domicile of the Commission at the capitol in Atlanta, Fulton County, and no court outside of that county shall have jurisdiction in any suit brought against the Commission.

Section 15. The contingent expenses of the Commission shall not exceed $3,000 a year. The salary of the Chairman of the Commission is $4,000. (Salaries of other members not mentioned in this law.) The salary of the Secretary is $2,000. The printing fund is $2,000 a year. A stenographer may be employed at not over $1,200 a year.

Section 16. The Governor is authorized to appoint an attorney to the Commission for a term of four years at $2,500 a year. The attorney may be removed by the Governor at any time.

The Railroads of Mexico.*

BY FRDIS G. ROBINSON, C.E.,
Formerly of the Engineering Department of the Mexican Central.

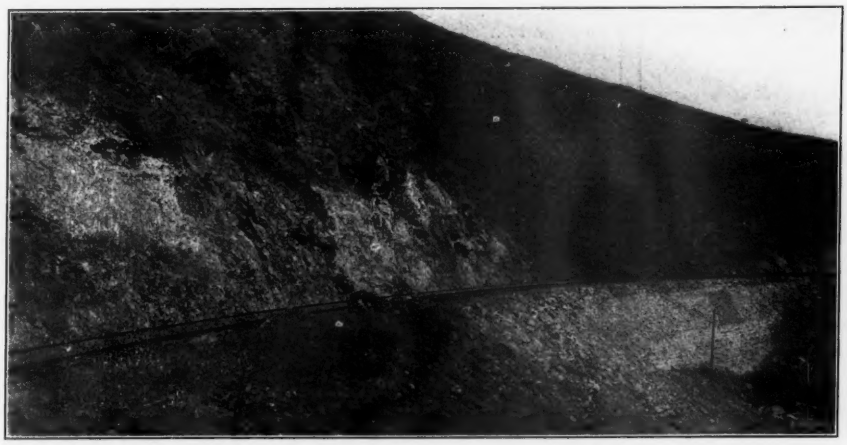
IV.

LOCATION AND CONSTRUCTION.

A large part of the railroads of Mexico have been planned and organized by railroad men from the United States, and American standards of location and construction have been generally followed. The work has usually been in charge of engineers who gained their experience on the railroads of the United States, especially on those roads located through similar topographical conditions. Field parties for location work, as usually made up, include the engineer in charge, transitman, levelman and topographer, these four commonly being Americans, while the other members of the party are usually Mexicans, the labor being performed by the common peon. While a party thus constituted could not be expected to do an amount of work equal to that done by a well trained American party, yet there will often be developed from such workmen a chainman or rodman who will not suffer from a comparison with one of any other nationality. The daily wage paid these workers varies from 50 centavos to one peso, while one of exceptional ability would get better pay by the month. The company, while it provides tents for peon laborers, makes no provision for feeding them, and in this regard they must look after themselves.

The peon is originally a laborer on the haciendas of the country, and is held there by force if he happens to be in debt to the proprietors—a condition that is often easy to bring about. But when once freed from this debt under which he is held, he becomes a rover without home ties and feels as much at home in camps as elsewhere, so long as he has his family with him, a source of supply of strong drink within convenient distance, and no restraint upon his inclination to sing at all hours as much as it pleases him. The engineer or contractor who attempts to curb this inclination toward

*The first article was published in the *Railroad Gazette* of July 12, 1907; the second, in the issue of Aug. 9; the third in the issue of Aug. 30.



Mountain Construction, Showing Riprap Work.

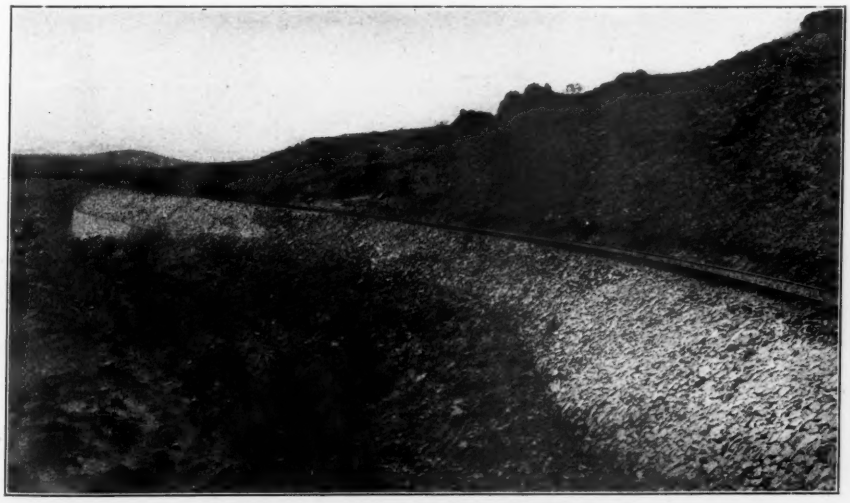
"wine, women and song" will find his camp unpopular and laborers difficult to obtain. The women members of the Mexicans' camp are not altogether an undesirable population, since they look after the board of the peons and do the washing and cleaning for the American members of the party.

Engineers in charge of parties receive from 250 to 350 pesos, and the instrument men from 150 to 250 pesos a month. These receive their expenses while out and are well cared for by the railroad in the matter of cooks, supplies and camp equipment.

An engineer contemplating entering railroad work in Mexico should if possible prepare himself as well as may be, along two lines. First, he should learn as much Spanish as possible. It is evident that an engineer can render much more valuable service for his company if he can use the language of the country in instructing and directing his workmen, in conducting the necessary business connected with the survey, in making reports and carrying on the correspondence as needed. In this connection it is pleasing to note the tendency in our schools to include Spanish in the engineering courses, frequently at the expense of time formerly devoted to the study of other languages. Second, he should become familiar with the metric system of weights and measures. Years ago the Mexican Government adopted the metric system and required its use in industries and trades, and now the French standards have come into pretty general use. In the stores the measuring stick shows the meter on one side and the *vara* on the other. The carpenter's rule likewise gives inches and centimeters. The tape lines manufactured for use in that country similarly have both the English and French measures. In some of the districts the people still think in *phenegas*, *almudes*, *varas*, even if they are obliged to buy in hektolitros, kilograms, metros—even as some American engineers still think in bushels, pounds and feet though using the new standards. On the whole the change has made slow progress in displacing the old units from the minds of the people, even in that country where the problem is a simple one compared to that which would follow a similar movement in other countries.

In the engineering operations connected with railroad building, the metric system is readily adapted and has some points of superiority. The length of chain now generally used on location and construction is one 20 meters long, divided into 100 links of 20 centimeters each. The curve formulas and tables found in the various handbooks or field books, based upon the use of a chain of 100 units, are readily used in laying out metric curves, for since 20 is one-fifth of 100, the curve data containing the radius as a factor will be found by dividing by five the corresponding tabular values based upon the chord of 100 units. There are certain tables published for use with the chord of 20 units, but as they are usually somewhat condensed it is probably shorter to make the simple division noted above than to use the shorter table and perform the necessary interpolations. For curve deflections, since the "degree of curve" is the angle subtended by one chord of 20 units, the deflection for one meter is one-fortieth part of the degree of curve and so equals in minutes 1.5 times the degree of curve. The advantages of the metric system are most apparent perhaps in construction work. On ordinary work cross sections are taken at each station, or 20 meters apart, and volumes are obtained by averaging end areas. Therefore the cubic contents of one station is found by adding the two end areas and multiplying by 10.

Standard Station Construction; Mexican Central.



Mountain Construction, Showing Riprap Work.

The Mexican Government requires the railroad companies operating within its territory to submit for its approval plans and studies for the preliminary location or reconnaissance plans and profiles of the final location, as well as plans and estimates of the permanent structures. The maps prepared in this way for the government are required to show contour lines for a distance of one kilometer each side from the line of the survey, the contours being spaced for differences of level of two or five meters, according to the nature of the topography. Much valuable data are thus accumulated in the government files since the various railroad surveys have pretty well covered the country. Many lines are surveyed only to be abandoned, while others are surveyed to secure information to be used at a later time when some quick move may be needed in the great game played by the railroad managers.

In location and construction the standards are as high as those used in this country. Thus, the Mexican Central, in its instructions

to engineers, while stating that the maximum grade is to be established as the preliminary survey may indicate, specifies that the maximum curve shall be of 6 deg. (20 meter chord, radius 627 ft.), and this degree was not exceeded in the location of that company's difficult Pacific line now under construction. It is provided that curves are to be compensated at the rate of .05 meter per degree of curve for curves of 0.7 degree and more, and at the rate of .06 meter for curves of less radius. Values of distance, rise and fall, unbroken tangents, etc., are given in conformity with the standards of other well located lines, while much stress is given to reducing the curvature to the smallest possible amount. Main line changes of location are based upon the cost of train operation as found from an examination of the records of the company and the amounts to be saved by the proposed change capitalized at 5 per cent. in the usual way.

When the final location is accepted and the work ordered the transit and level work of the location party are checked by the engineer in charge of construction, and drainage areas are determined (if this has not already been done by the location party) for proportioning the bridges and arriving at the openings required. Fortunate is the engineer who finishes this work before the arrival of the contractors, since he will be kept sufficiently busy thereafter.

The work is let by contract in the usual way, and the contractor sublets the least desirable parts of the work to others, often furnishing them such parts of their equipment as they do not require, or are pleased to be rid of. Many of these sub-contracts are let to small Mexican firms or individuals whose equipment is very meagre. In fact, many miles of embankment have been put in by Mexicans working only with shovel and basket, the earth being shoveled into a basket and carried to the embankment on the head or shoulders of the workmen.

Good scraper work on banks up to two meters is done with the small Mexican mules and native drivers, one such team being able to move from 45 to 50 cubic meters on a bank up to one meter high, and 25 to 35 cubic meters on banks up to two meters. These teams do not work to advantage on higher banks and in such cases the earth must be carried in carts or wheel scrapers from the cuts which are usually adjacent to the banks. In solid rock work of ordinary extent the drilling is done by hand by Mexican drillers. It is usually not difficult to secure skilled drillers, due to the training many men have had in the mines of the country. This work is paid for on the basis of amount of work done, and is often in charge of some disappointed though still hopeful American mine prospector. On larger works machine drills, conveyors, etc., are used as may be justified by the size of the contract.

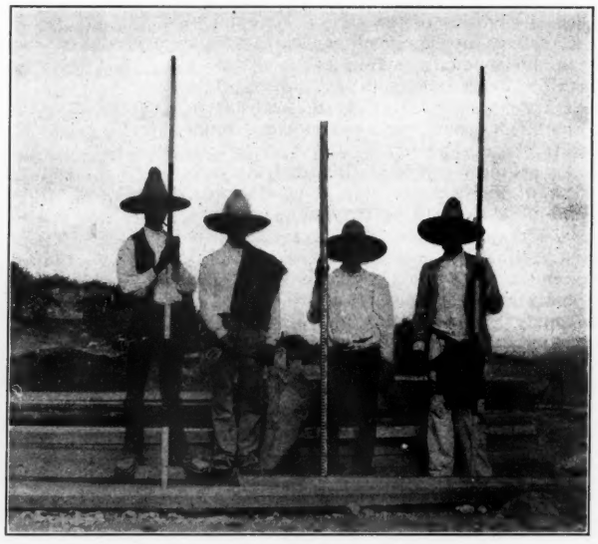
Standard Arch Culvert, Rubble Masonry.

Classifications of material are inclined to be liberal but the work is required to be well done. The following prices may be taken as indicating those generally prevailing on heavy work:

	Pesos, per cu. meter.	Dollars, per cu. yd.
Solid rock excavation in tunnel	7.50	2.87
Lava rock excavation	1.40	0.53
Solid rock excavation	1.30	0.50
Loose rock excavation	0.625	0.24
Earth hauled	0.35	0.13
Earth embankment	0.15	0.06
First-class masonry	15.00	5.75
Rubble masonry	8.00	3.00
Cement-concrete masonry	9.00	3.50
Tunnel concrete in place	11.50	4.40
Tunnel concrete in blocks	19.00	7.25
Haul on rock, per kilo. and mile	1.00	0.80
Clearing right of way, sq. meter and yd.	0.01	0.005
Other items at cost plus 15 per cent.		

In this list of prices a number of classes of work may be paid for on the basis of force account plus a certain per cent. for contractors' profit. This method of payment is followed for such work as could not readily be covered by the usual classifications, or which if such classification were attempted would lead to disagreement. In these cases the engineer is kept informed as to wages paid for labor and keeps a check force account. The matter of clearing of right-of-way is a case of this kind. In many parts of the country the land is completely covered with low brush, and in this case the price listed above may stand. Where the line crosses heavy or scattered timber land the payment may be by force account. Other works, as wet excavation, dry retaining walls, etc., may be paid for in this way.

In bidding for the work the contractor must consider the low wages to be paid for labor (from 50 centavos to one peso per day), the scarcity of water, provisions and feed, and other items. Probably the greatest difficulty of the contractor arises from employing the cheap peon labor. The peons are a class unknown in this country. Poorly paid, poorly fed for generations, they lack the personal ambition which produces the best results in any work. They are continually moving from place to place, so that the engineer or contractor is always breaking in new men, whose breaking in is no small matter. Of late years there has been a good demand for labor, so that the supply in many parts of the country is hardly adequate for the needs. This has naturally led to an increase in wages. This increase in wages has only increased the scarcity, since a Mexican laborer whose wages have been increased will be satisfied to work fewer days. Since all he wants is to exist, he considers it bad financial management to accumulate a surplus. He has no fears of the "rainy day." In some regards the peon is not dissimilar to the imported labor now much employed in this country, but he is not held in restraint by any contract of employment firm, as often happens in this country, and is entirely independent in his comings and goings.



Peon Members of Location Party.

The following figures indicate the nature of the roads as built in Mexico, taking the Mexican Central as the type:

Gage of track	4 ft. 8½ in.	.....
Width of roadbed: earth excavation	23 ft.	7 meters.
Loose rock excavation	20 "	6 "
Solid rock excavation	20 "	6 "
Earth embankment	20 "	6 "
Length of free haul	820 "	250 "
Shrinkage from quantities measured in bank for:		
Scraper work	5 per cent.	.....
Wagon work	10 "	.....
Basket work	15 "	.....
Subgrade in rock cuts	1 ft.	0.30
Berms for banks:		
Less than 5 meters high	6.5	2.0
Higher than 5 meters	10.0	3.0
Distance between reverse curves	200.0	60.0

The following figures are gathered from records of track laying material yards, and from tie camps, and may be of interest in making comparisons of labor costs, etc. The costs given are in centavos, equal to one-half cent, American money:

Standard rail on new work	76 lbs.
Standard frogs, number	9
Cost of curving rail (60-lbs.)	$0.07
" " straightening rail	0.06
" " sawing rail	1.10
" " drilling rail per hole	0.07
" " unloading rail per car	0.22
" " loading rail, per car	0.79
" " loading car containing 800 angle bars, 100 kegs spikes, 15 kegs bolts	2.30
" " unloading ties and throwing clear of track, per tie	0.00⅙
" " loading ties from pile	0.00⅓
Labor cost of hewn pine ties in the woods, each	0.07
Labor cost of cull ties, each	0.04
(These prices paid workmen working on piece basis.)	
Paid for haul of ties, 2 to 6 kilometers, per tie	0.13 to 0.20
Size of standard tie	6 in. x 8 in. x 8 ft.
Number of ties cut by native axemen per day	10 to 16
Tie renewals per year	6 per cent.

(To be continued.)

GENERAL NEWS SECTION

NOTES.

Australian coal, imported by the Southern Pacific for locomotives, is being carried as far east as Sparks, Nev.

On the Chihuahua division of the Mexican Central train service has been interrupted by a strike of firemen.

The Seaboard Air Line has put in effect in the state of Georgia the passenger rate of 2½ cents a mile, ordered by the State Railroad Commission.

The General Superintendent of the New York, Ontario & Western has issued an order limiting the speed of all passenger trains to 50 miles an hour and, on descending grades and on certain curves, to 40 miles an hour.

The Kansas state railroad commissioners have notified the Pullman Company that empty "dead head" sleeping cars attached to crowded trains are an offense to them. They want such cars open for the use of passengers "at the usual Pullman rates."

At Bridgeport, Pa., 30 enginemen, conductors, firemen and brakemen of the Philadelphia & Reading have been suspended for violation of the company's rule relative to the use of intoxicating drinks. According to the newspaper reports, these suspensions are indefinite.

On the Baltimore & Ohio a number of "Inspectors of Freight service" have been appointed, seven of them on the whole system. These men, formerly local agents and freight conductors, are to endeavor to secure the more careful loading and handling of freight with a view to reducing the bills for damages.

Texas, from being the most radical railroad regulator in the country, has lately become by comparison a very "slow" state; but the Railroad Commission has now aroused itself, and it is announced that within a month the Board will issue an order reducing passenger fares throughout the state 2½ cents a mile.

The Pennsylvania Railroad has established at Bedford, Pa., a school of telegraphy, with a view to increasing and improving the supply of operators to fill the several thousand positions of this kind on the company's lines east of Pittsburg. Bedford is 50 miles southwest from Huntingdon, which is on the middle division of the main turn.

The Long Island Railroad has made a slight increase in the pay of station agents and other station employees at a considerble number of stations, about 250 men being affected. The agents had presented to the superintendent a tentative schedule, but each individual case was dealt with on its merits, and there was no uniformity in the increases granted.

The Pittsburgh Car Service Association reports an average detention for the first seven months of this year as only 1.61 days, against 2.09 days in 1906. In this period the association reported 1,713,006 cars, of which 93 per cent. were released within free time. Of the average detention .47 was consumed by railroads and 1.14 by consignees. For the month of July 267,271 cars were reported, compared with 321,147 for July, 1906.

Hon. E. E. Clark, Interstate Commerce Commissioner, has been chosen as arbitrator of the dispute between the Colorado railroads and the Brotherhood of Railway Trainmen concerning the wages of yardmen, which recently caused a short strike on the Denver & Rio Grande. The railroad granted an increase of pay of 1 cent an hour, and the question for arbitration is whether the company shall grant an additional cent or any part thereof.

Chicago reports say that prominent shippers are beginning to complain loudly of the inability of the railroads to furnish them with freight cars of moderate size. In the constant movement toward a complete stock of large freight cars of uniform size the railroads have destroyed the old and smaller cars so rapidly that shippers of those kinds of freight which consignees want in 10-ton or 15-ton lots are being seriously inconvenienced.

Alpheus S. Frank, a young lawyer of New York City, has been sent to Sing Sing Prison for three years for subornation of perjury. Frank was the promoter of a fraudulent suit against the New York City Railway by a woman who claimed to have been injured while alighting from a street car, but who was found to be suing under a false name, and to have conspired with her husband, the conductor, to defraud the company, no injury having been obtained.

The State Corporation Commission of Virginia has ordered the adoption on October 1 of the revised passenger fares recently ordered by the Commission, on all of the roads of the state to which the reduction applies, except the Southern and the six other roads which secured injunctions in the United States Circuit Court. Under this order the rate will be 2 cents a mile on the Richmond, Fredericksburg & Potomac, the Washington, Southern, the New York, Philadelphia & Norfolk, the Virginia Southwestern and the Seaboard Air Line.

The Public Service Corporation, operating street railroad lines in Jersey City, Newark and adjacent places in New Jersey, announces that, in consequence of the large number of accidents to passengers, especially those riding on the running boards, the use of open cars will be discontinued. The company has ordered 200 convertible cars—closed cars, which can be arranged for hot weather use so as to be as comfortable as open cars. The new cars are to have fenders hung much lower than those now used by the company, with a view to making it impossible for a person to be rolled under.

"The National Industrial Traffic League," which is the name of the organization of representatives of large shippers recently formed, proposes to meet in Washington, October 10, and its officers will call upon the members of the Interstate Commerce Commission. The League favors the addition to the Interstate Commerce Commission of a railroad man and a member familiar with commercial affairs. It also recommends the amendment of the anti-trust law so as to permit railroads to make traffice agreements with each other. The 48 persons who attended the first meeting of the league are said to represent 16,450 firms and corporations.

The new Railroad Commission of Georgia is as prompt in getting to work as the Public Service Commission in New York, and has already issued a number of orders to the railroads. One of these requires a complete and detailed statement of all free transportation issued during the month of September. Another, which applies also to street railroads, and telephone, telegraph, electric light and electric light companies and cotton compresses, requires by November 1 a full statement of the property of every such corporation; and a third notifies the railroads that they will be held to a high standard in the maintenance of accommodations for passengers on trains and at stations.

The Chicago, Peoria & St. Louis, a line lying wholly within the state of Illinois and dependent solely on local traffic for the support of its passenger trains, is said to have been running its three daily passenger trains between Peoria and Springfield since July 1 at less than cost, the passenger traffic being, under the reduced rate ordered by the legislature, insufficient to cover the expense of running the trains. An officer of the road has expressed the intention of taking off some or all of the passenger trains and carrying the passengers on freights. Just to keep the General Manager from dwelling too long on this matter, the firemen of the road have presented a request for an increase in pay of 12 to 15 per cent.

New York State Accident Reports.

Rules to govern the reporting of accidents by railroad and street railway companies have been promulgated by the New York State Public Service Commission, Second district. Immediate notice by telegraph must be sent to the Commission of all accidents resulting in loss of life to passengers or employees; accidents occurring at grade crossings, resulting in death or serious injury to any person; derailments of passenger trains or locomotives or cars in passenger trains; collisions involving freight or passenger trains whether resulting in loss of life or not; explosions of locomotive boilers and accidents to locomotive boilers resulting in death or serious injury to any person.

The Commission requires prompt report by mail of every accident, whether covered in a preliminary notice by telegraph or not, upon a form prescribed by the Commission, to be sent immediately after the circumstances attending the accident shall have been ascertained. This form calls for details similar to those required in the reports made to the Federal government.

Block Signals on the Rock Island.

The Chicago, Rock Island & Pacific is now equipped with automatic block signals from Chicago to Utica, Ill., 95 miles, and signals are under construction on a length of 10 miles additional. The company has now decided to extend these signals as far as Iowa City on the Iowa division and to Muscatine on the Missouri division. Automatic signals are also to be put up on the line from Topeka, Kan., to Herington. When this work is finished the Rock Island will have automatic signals on 270 miles of double track and 80 miles of single track. On those parts of the road not equipped with automatic signals, the stations are being equipped with semaphores for the more convenient working of the telegraph block system.

This system is already in use on 500 miles of Rock Island lines and is being rapidly extended.

The Buell Automatic Stop and Cab Signal.

At Cameron Run, Va., on the Southern Railway, August 30, a test was made of the Buell automatic signal. This apparatus, by means of track-circuit control, protects a train in a given block section by automatically stopping any following train. Apparatus is provided on the locomotives for setting the air-brakes and also for giving both a visual and an audible signal in the cab. The test is reported as having been successful. It was witnessed by members of the Block Signal and Train Control Board of the Interstate Commerce Commission.

Thermit Welding.

At the recent meeting of the Master Blacksmiths' Association an individual paper and a report were presented on the subject of thermit welding and the method was strongly commended in both. It was stated that the first thermit weld on the Southern Pacific was made on the frame of an engine in April, 1905. The cylinders had a diameter of 22 in. and a piston stroke of 30 in., and the weight was 184,000 lbs. The frame was broken at the root of the pedestal where the main driving axle is located. The frame is in service to-day and shows no sign of defect.

To prepare the surfaces of the broken section, the ends of the frame should be corrugated by drilling holes through the frame and the ends kept practically clean. A jack-screw was placed between the jaws of the frame referred to for the purpose of opening the fracture $^1/_{16}$ in. After the weld had been completed the frame was too short, consequently it should have been spread one-eighth of an inch. In every case the broken section should be enforced with a band of thermit extending about 3 in. each side of the fracture and being about ¾ in. thick.

The method of making the mould for the molten thermit is explained in the pamphlet of the Goldschmidt Thermit Co., New York. The shape of the mould must be changed to meet conditions. Three or four different shapes will meet all the conditions required for repairing frames. The mould is usually made in halves and bolted together on the frame. Care should be taken that the mould is a perfect fit around the portion to be welded. To produce the contour desired in the inside of the mould is to make a pattern of wood similar to the shape the reinforced portion of the frame is desired after being completed. The mould being bolted to the frame, the ends of the frame should be brought to a red heat by passing a pipe gasolene burner through the pouring hole. The crucible of thermit is now placed over the pouring hole and ignited. In a few seconds the work is completed.

As soon as the molten thermit begins to congeal release the jack-screw slowly so that the spring of the frame will compress the heated thermit and equalize the shrinkage that must take place by the metal cooling. Many frames have been repaired by this method with a small percentage of failure.

It also appears from the report that on one road thermit is used in the construction of new engines. The statement is that a class of engine is now being built that has the forward pedestal and front end combined. This part is made of steel and is welded to a wrought iron frame with thermit, doing away with the front end splice and thus making a continuous frame.

In addition to frame welding the method is also in use for welding connecting rods, of which there are seven in service. It is stated also that after the reinforcing collar was machined off and the rod finished to standard size, it was impossible to see by the use of a glass where the weld was made.

These rods are in service and one of the engines has since passed through the shop, and after careful inspection the rod was found in perfect condition. The method of doing this class of work is as follows: The broken part is drilled 2 in. from the broken line. The mould is made over the break, using a piece of material which is soft steel taking the place of the broken piece. To hold the new piece in line a clamp is used and as soon as the thermit has entered the mould we use this clamp to draw the new piece together from ½ to ⅝ in., when the thermit is in liquid form, thus making a perfect weld, doing away with all tendencies due to air cavities. After the welds are machined they are taken to the smith shop and heated to a red heat and looked over carefully. This is a simple method and often puts an engine back in service in a very short time.

All of the above welds have been made by heating the work through the riser opening to a red heat. Since this method has been used there have been no failures.

In spite of this endorsement of the process by both contributions to the subject the author of the individual paper, Mr. Uren, closes with the remark that he does not wish it to be understood that this method is as good as the blacksmith method, forge, steam-hammer and anvil. However, in emergency cases when an engine comes in with a broken frame, by the thermit method the frame can be repaired and go into service the next day, and oftentimes will serve the purpose until the engine comes in for general repairs. I should advise that when engines come in for general repairs the frames be closely examined, and if defects are found bring the frame to the blacksmith shop and have it put in perfect order.

New Jersey Demurrage Law.

The Legislature of New Jersey at its last session amended the railroad law of 1903 so as to forbid the collection of demurrage on freight cars until after three full days. The law has a proviso that if a car, on account of switching or otherwise, is off from the team track more than one working hour in a day, that day cannot be counted against the consignee. The law gives the railroad a lien on freight for demurrage charges assessed according to the law, but provides that if the consignee gives a bond of $50 (or double the demurrage charge) he may take his freight, notwithstanding the lien.

A Quiet Place.

Glenfield tunnel, on the Leicester & Swannington, a part of the Midland Railway system of England, is described as the oldest tunnel in the world. It is about a mile long. Only four passenger trains pass through the tunnel each week day, and from Saturday night until Monday morning it is closed by a padlocked door at either end.

Steel Rail Exports.

The exports of steel rails for the first seven months of 1907 show very little increase over the similar period of 1906, as far as value is concerned. This year exports have amounted to $5,387,947, as compared with $5,345,509 in 1906. The quantity shipped abroad has been about 20,000 tons less in this year, 180,720 tons being sent abroad in the seven months as against 203,352 in 1906. The aggregate value was brought up by the increased price which American manufacturers got for their products. During this year foreign consumers have paid an average price of $29.81 per ton for steel rails, as against $26.28 last year.

The exports appear in detail as follows:

Exported to—	1907.	1906.
Europe	$1,178	$11,211
British North America	282,896	1,344,473
Central America and Br. Honduras.	446,094	475,757
Mexico	728,088	426,879
West Indies and Bermuda	448,192	616,586
South America	1,640,233	1,890,360
Japan	195,534	237,425
Other Asia and Oceania	1,619,506	332,593
British Africa	7,741	9,849
Other Africa	17,885	376
Total	$5,387,347	$5,345,509

There is practically no market at all for American steel rails in Europe; but 52 tons have been sent there in seven months. The railroad development of British North America is much retarded at present, there being a decline of over $1,000,000 in its demand in the time under consideration. South America likewise showed a falling off.

The Far Eastern markets, outside of Japan, have been much more profitable. The territories grouped under "other Asia and Oceania," purchased $1,286,913 more than in the first seven months of 1906.

The Ashokan Dam.

The Board of Water Supply recently received bids for the building of the Ashokan dam, which is part of the new reservoir work under way in the Catskill mountains to supply water to New York city. The lowest bid came from the John Pierce Company and was $10,315,350, over $2,000,000 less than the engineer's estimates. This bid was not accepted. It is understood that the John Pierce Company told the Board that because of the company's inexperience in reservoir work it had underestimated the cost, although it stood ready to carry out the contract at the price offered. The contract was awarded to the MacArthur Brothers Company and Winston & Company, who jointly bid $12,669,775.

New Oriental Steamship Line.

The American & Manchurian Line has been organized in connection with the United States Steel Products Export Company, which handles the export trade of the United States Steel Corporation. The vessels will ply between New York and Dalny, Japan, China and Straits Settlements ports. The line will first be used to carry steel work to be used on the South Manchurian Railroad.

The first ship, the "Kabinga," left New York last Saturday, carrying 12,000 tons of steel, including 1,500 tons of bridge mate-

rial, 2,500 tons of rails, 110 cars, 18 locomotives and a large quantity of machinery. This consignment is the first shipment of a total of 163,000 tons of rails, 8,000 tons of bridge material, 250 locomotives and 3,000 cars that are to be used on the Manchurian road, and are to be shipped as soon as possible, the Carnegie mills having received instructions to rush the work as fast as they can. The "Kabinga" carries what is said to be the largest cargo of steel work that has ever been sent to the far East.

New York Rules for Boiler Inspection.

The New York State Public Service Commission, Second district, has formulated rules for the inspection of locomotive boilers. Detailed instructions are given as to the time and method of inspection of all parts, including steam gages, safety valves and staybolts. Each boiler must be washed out at least once a month and a thorough inspection made once every three months; and it must be tested by hydrostatic pressure not less than once a year. All inspections must be made by competent boilermakers and sworn reports filed with the commission within 10 days after each inspection.

Wells-Fargo Earnings.

Wells, Fargo & Co. earned during the fiscal year ended July 31, 1907, nearly 54 per cent. on its capital stock. The company pays 10 per cent. dividends. The earnings were as follows:

	1907.		Changes.
Gross earnings	$22,934,425	Inc.	$4,251,390
Expenses	19,566,403	"	3,428,313
Net earnings	$3,368,022	Inc.	$823,077
Other income	945,882	"	425,865
Available for dividends	$4,313,904	Inc.	$1,248,942

MANUFACTURING AND BUSINESS.

The Pennsylvania has ordered from Henry Pels & Co., New York, a large T-bar and angle shear for installation at the Juniata shops, Altoona, Pa.

The T. B. Arnold Supply Co., St. Louis, Mo., and Theodore Thomas & Co., Chicago, have been made agents of the Maryland Railway Supply Co., makers of the "spike-strut" rail fastener, Baltimore, Md.

A. Bruce has been appointed American representative of the Great Central Railway of England, succeeding F. Patman, who has left for England to take a higher office in the company. The New York office has been moved from 1 Broadway to 355 Broadway.

Barney Barkley, Superintendent of Construction in charge of the work which the Grigsby Construction Company, De Ridder, La., has been doing on the extension of the Jasper & Eastern, a Gulf, Colorado & Santa Fe line, has resigned to take a similar position with the Ball-Gardner Construction Company, Dallas, Tex.

The name of the Detroit Graphite Manufacturing Co., Detroit, Mich., has been changed to the Detroit Graphite Co. F. W. Davis, Jr., has been elected Vice-President, and T. R. Wyles, Second Vice-President. Extensive additions and improvements were recently made to the building and machinery departments, largely increasing the facilities.

At the annual meeting of the stockholders of the Locomotive Appliance Co., Chicago, held August 15, the following directors were elected for the ensuing year: Frank W. Furry, J. B. Allfree, Willis C. Squire, J. J. McCarthy, E. H. Allfree and Ira C. Hubbell, all of Chicago; Clarence H. Howard, C. A. Thompson and Ira B. Kegler, of St. Louis, Mo.; F. B. Olney, Ludington, Mich., and H. S. Gray, Benton Harbor, Mich.

Iron and Steel.

The North Georgia Marble Company, Ellijay, Ga., is in the market for second-hand light portable track or rails.

Bids were asked September 5 for about 5,000 tons of structural steel, castings, rails, etc., for the remaining material necessary to complete the Blackwells Island bridge approaches in the Borough of Queens, New York city.

The McClintic-Marshall Construction Co. has contracts for 13,000 tons of structural steel for new piers in New York; also an order for 1,700 tons for a viaduct for the Chicago, Milwaukee & St. Paul, and several smaller orders.

The rail mills of the Pittsburg district have received notice from the Baltimore & Ohio that it will need about 75,000 tons of rails for 1908 delivery, and that the specifications will be handed in later. The railroad is said to be holding back its orders awaiting the result of conferences between the committee of the American Railway Association and the Steel Corporation.

The National Transcontinental (Canada) has ordered about 36,000 tons of rails for the Grand Trunk Pacific, the orders being divided between the Dominion Iron & Steel Co., of Sydney, N. S., and the Algoma Steel Works, Sault Ste. Marie. The contract price of the Algoma company's rails, f. o. b. Fort William, was about $34 a ton, and that of the Dominion Steel Co., for delivery at Quebec, about 50 cents a ton less.

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad conventions and engineering societies, etc., see advertising page 24.)

Central Railway Club.

At the meeting of this club to be held at Buffalo, N. Y., Sept. 13, a paper on "Some of the Requirements of Modern Air-Brakes," by J. P. Kelly, of the Westinghouse Air-Brake Company, will be presented.

Railway Signal Association.

At the September meeting of this association, which is to be held at the Great Northern Hotel, Chicago, next Tuesday, beginning at 10 a.m., the subject for discussion will be the Committee Report on Standard Specifications for Electric Interlocking. The committee desires the views of members preparatory to making a final report at the annual meeting, which is to be held at Milwaukee October 8, 9 and 10.

Iron and Steel Institute.

At the autumn meeting of this institute to be held in Vienna, Austria, September 23 and 24, the papers to be submitted will probably include the following: Steel and Meteoric Iron, by Professor F. Berwerth; Quantity of Blast Furnace Gas for a Given Make of Pig Iron, by Professor Josef von Ehrenwerth; Application of the Laws of Physical Chemistry to the Metallurgy of Iron, by Baron H. von Jüptner; Case Hardening of Mild Steel, by C. O. Bannister and J. W. Lambert; New Blue-Black Paint as a Protective Covering for Iron, by F. J. R. Carulla; Hardening of Steel, by L. Demozay; Structure of Hardened Steel, by Percy Longmuir; Case Hardening, by G. Shaw Scott, M. Sc.; Ageing of Mild Steel, by C. E. Stromeyer; Economical Distribution of Electric Power from Blast Furnaces, by B. H. Thwaite.

ELECTIONS AND APPOINTMENTS.

Executive, Financial and Legal Officers.

Alabama & Vicksburg.—See New Orleans & North-eastern.

Beaumont & Great Northern.—G. W. Pennell, Vice-President, has been elected also Treasurer, succeeding, as Treasurer, J. H. Pearcy, who remains Secretary.

Chicago, Cincinnati & Louisville.—The office of G. A. S. Graves, Assistant Treasurer and Purchasing Agent, has been moved from Cincinnati, Ohio, to Chicago, where the other general offices now are.

Chicago, Indianapolis & Louisville.—N. Staat, tariff and rate clerk in the freight department, has been appointed Assistant General Freight Agent.

Georgia State Railroad Commission.—S. G. McLendon has been elected Chairman. Under the law passed by the last legislature, the number of members of the Commission has been increased from three to five. The new members are Judge George W. Hillyer, of Atlanta, and Fuller E. Calloway, of La Grange.

Grand Trunk Pacific.—G. W. Caye, chief clerk to the General Manager, has been appointed Assistant to the Vice-President and General Manager, with office at Winnipeg, Man.

Mobile, Jackson & Kansas City.—The office of Assistant to the President, held by W. F. Owen, has been abolished. Mr. Owen remains General Manager. H. C. Snyder has been elected Assistant Secretary and Assistant Treasurer at New York, succeeding R. H. Sherwood, resigned.

New Orleans & North-eastern.—E. Ford, General Manager of this road and of the Alabama & Vicksburg and of the Vicksburg, Shreveport & Pacific, has been appointed Assistant to the President of the three roads. D. D. Curran, President, is now also General Manager.

Oklahoma Central.—D. I. Green has been appointed Auditor, with office at Purcell, Ind. T., succeeding W. P. Wissmann, resigned. G. W. Parker has been appointed Assistant Auditor, with office at Purcell.

Southern.—C. P. Cooper, General Superintendent of the St. Louis-Louisville lines, has been appointed Manager of these lines and his former position has been abolished.

Vicksburg, Shreveport & Pacific.—See New Orleans & North-eastern.

Operating Officers.

Alabama & Vicksburg.—See New Orleans & North-eastern.

Ann Arbor.—The headquarters of W. F. Bradley, Superintendent, have been moved from Owosso, Mich., to Toledo, Ohio.

Colorado & Southern.—See Denver & Rio Grande.

Denver & Rio Grande.—A. F. Brewer, Superintendent of Car Service of the Colorado & Southern, has been appointed Superintendent of Transportation of the Denver & Rio Grande, with office at Denver, Colo., succeeding W. A. Whitney, resigned.

Galveston, Harrisburg & San Antonio.—George S. Waid, Assistant Superintendent at El Paso, Tex., has been appointed Acting Superintendent at that place, succeeding to the duties of S. C. Marks, who has been given indefinite leave of absence because of ill health.

Louisville & Nashville.—James Allyn Morrison, who was recently appointed Assistant Superintendent at Birmingham, Ala., was born in 1868 at Sonora, Ky. After a public school education, he began railroad work, in 1886, as a telegraph operator on the Louisville & Nashville. After serving in different despatchers' offices as operator and, later, extra despatcher, he was made chief despatcher at Birmingham in 1892. He was transferred to the same position on the Montgomery division in 1897 and was appointed Trainmaster of the Decatur division in 1902, where he remained until his recent promotion.

Mobile, Jackson & Kansas City.—The office of General Superintendent, held by H. S. Jones, has been abolished. Mr. Jones remains Chief Engineer. See this company under Executive, Financial and Legal Officers.

New Orleans & North-eastern.—E. A. Kelly, Car Accountant of this road and of the Alabama & Vicksburg, and of the Vicksburg, Shreveport & Pacific, has been appointed to the new office of Superintendent of Transportation, and his former office has been abolished.

New York Central & Hudson River.—S. J. Kearns, chief despatcher of the Western division, has been appointed Assistant Superintendent of that division, with office at Syracuse, N. Y.

Oregon Railroad & Navigation.—The headquarters of the Assistant Superintendent of the Washington division have been moved from Starbuck, Wash., to Spokane. R. O. Cowling has been appointed Trainmaster at Starbuck.

Trinity & Brazos Valley.—Patrick Owens has been appointed Trainmaster at Teague, Tex.

Vicksburg, Shreveport & Pacific.—See New Orleans & North-eastern.

Traffic Officers.

Chicago, Cincinnati & Louisville.—T. C. Beyland, Assistant General Freight Agent, has resigned to go into other business.

Chicago Great Western.—C. D. Thompson, General Agent at Duluth, Minn., has resigned to go into other business.

Colorado Midland.—N. L. Drew, City Passenger Agent at Denver, Colo., has been appointed General Agent at Colorado Springs, Colo., succeeding C. S. Browne, transferred.

Denver & Rio Grande.—W. H. Paul has been appointed General Agent at Goldfield, Nev.

Georgia, Florida & Alabama.—B. C. Prince has been appointed Acting Traffic Manager, with office at Bainbridge, Ga., succeeding to the duties of J. H. McWilliams, resigned.

Missouri Pacific.—R. T. G. Matthews, traveling passenger agent at Louisville, Ky., has been appointed General Agent of the passenger department at Cincinnati, Ohio.

Seaboard Air Line.—J. G. Cantrell, Assistant General Freight Agent at Birmingham, has been appointed to the new office of General Western Freight Agent, with office at St. Louis, Mo. E. T. Steele succeeds Mr. Cantrell.

Engineering and Rolling Stock Officers.

Chicago, Burlington & Quincy.—W. F. Ackerman, superintendent of shops at Havelock, Neb., has been appointed Assistant Superintendent of Motive Power of the Lines West of the Missouri river, with office at Lincoln, Neb., succeeding J. Dietrich, transferred.

Mexican Central.—J. M. Fulton, Master Mechanic at Aguascalientes, has resigned to become general foreman of the El Paso & Southwestern shops at Tucumcari, N. Mex.

Texas Central.—A. S. Grant has been appointed Master Mechanic, with office at Walnut Springs, Tex., succeeding N. L. Smitham, resigned.

Wabash.—E. F. Needham, Master Mechanic at Springfield, Ill., has been appointed Superintendent of the Locomotive and Car Department, with office at Springfield, Ill., succeeding J. B. Barnes, retired. Mr. Needham began railroad work in 1880 as an apprentice in the Fort Wayne shops of the Wabash. He was made foreman of these shops in 1894 and was transferred to the same position at Springfield, Ill., in 1899. In December, 1901, he was appointed Assistant Master Mechanic at Decatur, Ill., and a few months later was transferred to the same position at Ashley, Ind. In the fall of 1902 he was made Master Mechanic at Fort Wayne, and in the spring of 1906 was appointed Master Mechanic of the Decatur and Springfield divisions, where he remained until his present promotion.

LOCOMOTIVE BUILDING.

The South Dakota Central is in the market for four second-hand locomotives.

The Isthmian Canal Commission, as reported in the *Railroad Gazette* of August 23, opened bids on August 30 on 12 four-wheel saddle tank 3-ft. gage locomotives. The lowest bid, according to press despatches, was that of the Davenport Locomotive Works, whose price was $36,996, or $37,956, ready for operation at Colon.

The Tonopah & Goldfield, as reported in the *Railroad Gazette* of August 23, has ordered eight simple freight locomotives from the Baldwin Locomotive Works.

General Dimensions.

Type	Simple freight
Weight, total	183,800 lbs.
Weight on drivers	165,000 "
Diameter of drivers	55 in.
Cylinders	22 in. x 28 "
Boiler, working steam pressure	180 lbs.
" number of tubes	344
" diameter of tubes	2 in.
" length of tubes	14 ft. 6 "
Firebox, length	121 "
" width	41⅝ "
" material	Homogeneous steel
" grate area	34.97 sq. ft.
Heating surface, total	2,792.0 "
Tank capacity	7,000 gals.
Coal capacity	13 tons

Special Equipment.

Air brakes	Westinghouse
Boiler lagging	Magnesia
Brake-shoes	Streeter
Couplers	Tower
Injector	Hancock
Piston rod packings	United States
Valve rod packings	United States
Safety Valve	Crosby
Sanding devices	Leach
Sight-feed lubricators	Nathan bull's-eye
Steam gages	Ashcroft
Tires—driving wheels	Midvale
Tires—truck wheels	Midvale

CAR BUILDING.

The Grand Trunk is in the market for 25 first-class passenger cars.

The Chicago Refrigerator Car Company, Chicago, is in the market for 100 refrigerator cars.

The Twin City Rapid Transit, Minneapolis, Minn., will build about 100 additional electric cars at its own shops.

The Denver & Rio Grande has ordered 1,000 steel ore cars of 100,000 lbs. capacity from the Pressed Steel Car Co.

The South Dakota Central is in the market for about 50 box cars and five hopper bottom gondola cars, all second-hand.

The Mississippi Central is in the market for two passenger coaches, two combination, baggage, mail and express cars and one compartment car.

The Union Pacific is building a number of 31-ft. steel trailer cars at its Omaha shops, similar in shape to the gasolene motor cars, except that they are four-wheel cars fitted up for baggage, mail and express.

The Union Pacific, as reported in the *Railroad Gazette* of August 9, is building 22 gasolene steel motor cars at its Omaha shops. These cars will weigh 60,000 lbs. and measure 56 ft. 11½ in. long, 9 ft. 8¼ in. wide and 12 ft. $1^3/_{16}$ in. high, over all. The special equipment includes:

Bolsters	Comonwealth Steel Co.
Brake-beams	Waycott and Damascus
Brake-shoes	Congdon type
Couplers	Climax
Curtain fixtures	Hartshorn tin rollers
Curtain material	Pantasote
Dust guards	Union Pacific standard
Paint	Sherwin-Williams
Seats	Union Pacific
Springs	Union Pacific
Trucks	Union Pacific built-up

The Harriman Lines are asking prices on 5,000 steel underframe box cars of 100,000 lbs. capacity, 250 steel underframe box cars

of 80,000 lbs. capacity, 500 steel underframe gondola cars of 100,000 lbs. capacity, and 250 steel underframe flat cars of 80,000 lbs. capacity.

The Virginia & Southwestern, as reported in the *Railroad Gazette* of August 23, has ordered 500 drop bottom gondola cars of 80,000 lbs. capacity from the Western Steel Car & Foundry Company. These cars will weigh 35,000 lbs. and will measure 34 ft. 4¼ in. long and 9 ft. 5 in. wide, inside measurements, and 36 ft. 3 in. long and 8 ft. 3¾ in. high, over all. Bodies and underframes will be of wood. The special equipment includes:

Bolsters	Scullin-Gallagher
Brake-beams	Simplex
Brake-shoes	American Brake-Shoe & Foundry Co.
Brakes	Westinghouse
Brasses	Ajax Plastic Bronze
Couplers	Major
Draft rigging	400 Miner; 100 Farlow
Journal boxes	Symington
Paint	Frazer Paint Co.
Springs	Railway Steel-Spring Co.

The Buffalo & Susquehanna, as reported in the *Railroad Gazette* of August 23, has ordered 200 steel underframe box cars of 80,000 lbs. capacity, 200 center dump hopper cars of 100,000 lbs. capacity, 500 gondola cars of 100,000 lbs. capacity and 100 general service cars of 100,000 lbs. capacity from the Pressed Steel Car Company, the box cars and the general service cars to be built by the Western Steel Car & Foundry Company. All are for October delivery, except that the general service cars are to be delivered after the completion of the hopper cars. The box cars will be 39 ft. 4⅝ in. long and 8 ft. 6 in. wide, inside measurements, and 40 ft. long and 9 ft. 1⅝ in. wide, over all. Bodies will be of wood and the underframes of steel. The center dump hopper cars will be 30 ft. ¼ in. long and 9 ft. 6 in. wide, inside measurements, and 31 ft. 6 in. long and 10 ft. 1½ in. wide, over all. Underframes will be of steel. The gondola cars will be 41 ft. 9 in. long and 9 ft. 4⅞ in. wide, inside measurements, and 43 ft. 3 in. long, 9 ft. 11⅞ in. wide and 7 ft. 5⅛ in. high, over all. Bodies and underframes will be of steel. The general service cars will be 41 ft. 9 in. long and 9 ft. 6¾ in. wide, inside measurements, and 42 ft. 9 in. long, 10 ft. 2 in. wide and 8 ft. 9 in. high, over all. Underframes will be of pressed steel. The special equipment for all cars includes:

Bolsters	Pressed steel for gondola and general service
Brasses	Spiral
Couplers	Climax
Centerplates & side bearings	Hartman for general service cars.
Draft rigging	Miner
Dust guards	Gould
Journal boxes	Gould
Springs	Suitable for arch-bar trucks, for general service cars
Trucks	Arch-bar for all except box cars
Truck frames	Arch type for box cars
Wheels	700-lb., for general service cars

RAILROAD STRUCTURES.

ALTOONA, PA.—The wheel foundry shop of the Pennsylvania, which has been in use for the past 30 years, is to be torn down and the site is to be used for a large boiler shop. Contracts for the new shop are to be let this fall.

DECATUR, ILL.—The Wabash, it is said, has recently given an order to put up a new roundhouse and machine shops here.

RUTHERFORD, PA.—The Philadelphia & Reading has given a contract to Augustus Wildman, of Harrisburg, to put up a brick power house on concrete foundations 56 ft. x 56 ft., a fan house 20 ft. x 24 ft. and a viaduct. The new plant will supply electric lighting for the entire yard and power and heat for the new shops. The cost of the new plant, exclusive of machinery, is about $25,000, and about $300,000 will be spent for machinery.

WASHINGTON, D. C.—Bids for furnishing material for a single-track steel railroad bridge over the Chagres river at Gamboa, Canal Zone, were recently opened at the office of the Isthmian Canal Commission. They were: Penn Bridge Company, Beaver Falls, Pa., $59,000; United States Steel Products & Export Co., New York, $62,090; Receivers for Milliken Bros., New York, $73,300; R. G. Hoffman & Co., Baltimore, Md., $77,827; Cowing Engineering Co., Cleveland, Ohio, $82,086, and Interstate Engineering Co., Bedford, Pa., $85,847. The Penn Bridge Company in addition to being the lowest bidder guarantees the earliest delivery.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

BINGHAM CENTRAL.—Incorporated in Utah with $500,000 capital to build a line about 50 miles from Salt Lake City, Utah, south to Bingham and the tributary smelting and mining districts. The officers are: A. C. Ellis, Jr., President; T. W. Sloan, Vice-President; John Weir, Jr., Second Vice-President; W. T. Gunter, Secretary, and W. F. Adams, Treasurer. R. G. Schulder is a Director, and F. A. Heinze is also interested.

CANADIAN PACIFIC.—Arrangements, it is said, are being made for the construction of the line from Kamloops, B. C., northeast via Yellow Head Pass in the Rockies, thence east to Edmonton, 600 miles. The proposed line will have a much easier grade than the existing line. The work will cost about $20,000,000, as there is much rock work.

The Guelph & Goderich branch from Guelph, Ont., west to Goderich, 80 miles, has been opened for passenger traffic.

CHICAGO, BURLINGTON & QUINCY.—Surveys, it is said, are being made by this company for a connecting line from Francis, Mo., northwest via Clark to Macon, on the Hannibal & St. Joseph line, 160 miles.

CLEVELAND, CINCINNATI, CHICAGO & ST. LOUIS.—This company, which has work under way straightening its lines, raising the grade and eliminating numerous curves from Indianapolis, Ind., west to Greencastle, 40 miles, expects to have the work finished by November. The work includes two triple arch cement bridges, which have been built over Big and Little White Lick creeks at a cost of $160,000. The line will be practically level. It is double-track and laid with 90-lb. rails.

FAIRMONT & SOUTHERN.—Incorporated in Pennsylvania, with $25,000 capital, to build a line from Belington, W. Va., on the Baltimore & Ohio, the Coal & Coke and the Western Maryland, north to Pittsburg, Pa., 125 miles. Ralph Overholt, of Pittsburg, and B. F. Overholt, of Scottdale, Pa., are the principal promoters.

GEORGIA & FLORIDA.—This company, which proposes to build a number of connecting links between existing lines to complete a through line from Augusta, Ga., to Madison, Fla., has given a contract to Schofield & Sons, of Philadelphia, for part of the work. (May 17, p. 695.)

GRAND TRUNK.—This company is to start work on the Kingston, Smith's Falls & Ottawa cut-off projected from Rideau, six miles east of Kingston, Ont., north via Smith's Falls to a point a few miles west of Ottawa, on the Canada Atlantic, as soon as the railway department of the government has approved its route map.

GRAND TRUNK PACIFIC.—It is said that this company has bought the Vancouver, Westminster & Yukon's charter to build from Vancouver north to a connection with the Grand Trunk Pacific.

GREAT NORTHERN.—Double tracking of the mountain district is to be begun as soon as the surveys are made, according to a reported statement of Chief Engineer A. H. Hogeland. The work will be on the west slope of the Rockies from Summit northwest to Whitefish, 68 miles. Much of the line will be rebuilt to eliminate curves and to reduce the grade.

This company is reported building under the name of the Crows Nest Southern, from Fernie, B. C., north to Michel, 20 miles, in the Crows Nest coal country.

GREENVILLE & KNOXVILLE.—Contracts, it is said, are to be let about September 15 for extending this line to River Falls, S. C., 27 miles. The line is now in operation from Greenville, S. C., north to Travelers Rest, 10 miles. The northern terminus is to be at Henderson, N. C., 56 miles from Greenville. (May 24, p. 727.)

GUELPH & GODERICH.—See Canadian Pacific.

ILLINOIS TRACTION.—The McKinley Interurban Electric Railway has made arrangements to enter St. Louis as contemplated in its original plans. At Venice the company is to have an independent terminal in connection with its new bridge over the Mississippi river from Venice to the foot of Salisbury street, St. Louis. The company has ground for yards, terminals and stations at Salisbury street in St. Louis, and adjacent to the stock yards at Venice. The land, on both sides of the river, is situated at the approaches of the proposed bridge. The Venice City Council has granted the company right of way over a mile of city streets, also over a mile of private property for the bridge approach. Work is to begin on the bridge piers as soon as possible. (May 10, p. 663.)

JOPLIN & PITTSBURGH (ELECTRIC).—This company, incorporated last spring in Missouri with $5,000,000 capital, is expected soon to take over the properties of the Pittsburgh Railway & Light Company of Pittsburgh, Kan., operating 32 miles of electric roads, and the Joplin & Pittsburgh Street Railway Company, the latter having under construction a line to Joplin, Mo., about 48 miles. The new owners propose to build 26 miles of railroad to connect the Pittsburgh lines with the Joplin lines. (June 28, p. 949.)

JOPLIN & PITTSBURGH STREET RAILWAY.—See Joplin & Pittsburgh.

KINGSTON, SMITH'S FALLS & OTTAWA.—See Grand Trunk.

MEDINA, BATAVIA & ONTARIO (ELECTRIC).—Work has been begun on this proposed electric line. There are to be two divisions, one from Olcott, N. Y., northeast eight miles to Somerset, along the lake shore, through Niagara county, and the other from Olcott southeast to Medina and thence to Batavia, 35 miles. The line has been projected for several years.

Mexican Central.—An officer writes that on the Tampico Short Line only about 191 miles remains to be built, 50 miles of which is under contract (from the Panuco river south), and that no bids are being asked for the remainder of the work. The line as located from the City of Mexico to Tampico will be 304 miles long; of this 142 miles, from Tampico to the foot of the plateau, will have a .5 per cent. grade, and on 54 miles the maximum will be 2.5 per cent., with 8 deg. curves. The report that the line is eventually to be extended to the United States border at Matamoras, where a bridge is to be built over the Rio Grande river to Brownsville, Tex., has no official confirmation. (May 3, p. 631.)

Pagosa Springs & Del Norte.—Incorporated in Colorado to build a line from Juanita, in Archuleta county, north to Pagosa Springs, thence northeast via Mineral county to Del Norte, 70 miles. Both of these places are on the Denver & Rio Grande. The incorporators include: Former State Treasurer Whitney Newton, H. N. Hawkins and F. Richardson.

Pittsburg, Binghamton & Eastern.—Announcement is made that the permanent location of this proposed line, under construction from Binghamton, N. Y., to Clearfield, Pa., 225 miles, has been made. From Binghamton the route is west through Owego, Sayre, Pa., thence southwest via Athens, Towanda, Canton, Williamsport, Jersey Shore, Lock Haven and Renovo, following closely the Susquehanna river to Clearfield, where connection is made for Pittsburg with the Buffalo, Rochester & Pittsburg. The grades are very light. (March 15, p. 390.)

Pittsburgh Railway & Light Company.—See Joplin & Pittsburgh.

Southern Pacific.—This company has recently laid track from West Port Arthur in to the city of Port Arthur to the site of its docks and prospective terminal. The company owns 160 acres of land along Taylors bayou, giving over a mile of water front, where a depth of 25 ft. of water is to be had.

On the 85-mile Alexandria branch of Morgan's Louisiana & Texas, 75-lb. rails are being laid to replace the present 60-lb. The work has been finished from Lafayette, Ala., north to Washington, 28 miles.

Sulphur, Colgate & Southeastern.—Surveys are being made by this company, organized to build a line from Sulphur, Ind. T., east through Hickory, Pontotoc and Colgate, thence southeast to Paris, Tex., about 150 miles. The Commercial Club of Hickory guarantees a terminal at that place and residents of Sulphur will pay part of the cost of the survey.

Tidewater Electric.—This company, reported to have secured valuable franchises in Gadsden, Birmingham and Tuscaloosa, Ala., has increased its capital from $100,000 to $150,000. The city of Bessemer ordered work on the line to be commenced September 2, or the franchise was to be forfeited. A time limit to commence work in Birmingham also exists.

Tonopah & Tidewater.—This road was opened for business September 1 to Death Valley Junction, Cal., 121 miles north of Ludlow. Also a branch from Death Valley Junction to Lila C, seven miles. The main line is being extended as rapidly as possible to Gold Center, Beatty and Rhyolite, Nevada.

Vancouver, Westminster & Yukon.—See Grand Trunk Pacific.

Wyoming Roads (Electric).—A franchise has been granted to W. J. Baker, President of the Northern Colorado Power Company, to build an electric line from Cheyenne, Wyo., northwest five miles to Fort Russell. Work to be begun by December.

RAILROAD CORPORATION NEWS.

American Light & Traction Company.—This company is offering to its stockholders for subscription at par $1,500,000 6 per cent. collateral notes payable in two, three or five years and convertible into either common or preferred stock at par.

Boston & Maine.—Results of operation for the year ended June 30, 1907, were as follows:

Gross earnings	$41,125,256	Inc.	$1,911,054
Operating expenses	30,968,397	"	1,615,029
Net earnings	$10,156,859	Inc.	$296,025
Other income	704,359	"	82,274
Gross income	$10,861,218	Inc.	$378,299
Interest, rental and taxes	8,233,237	Dec.	61,477
Net income	$2,627,981	Inc.	$439,776
Sinking fund payments	28,785	Dec.	107,500
Balance available for dividends	$2,599,196	Inc.	$547,276
Dividends of 7 per cent. on common and 6 per cent. on preferred	1,973,332	"	138,686
Additions and betterments charged to income	493,249	"	493,249
Surplus	$132,615	Dec.	$84,659

Central of Georgia.—The following committee has been appointed to protect the interests of the holders of the preference income bonds: C. Altschul, of Lazard Freres; R. Walter Levy, of Maitland, Coppell & Co., and Ernest Groesbeck, of Groesbeck & Co., all of New York; William Scott, of Scott & Stringfellow, Richmond, Va., and J. F. Minis, of Savannah, Ga. The bondholders contend that the company has earned the full 5 per cent. dividends on all three classes of these bonds, although the income account for the year ended June 30, 1907, shows only $33 surplus after paying 5 per cent. on the first incomes and 3.729 per cent. on the second incomes, nothing being paid on the third incomes. It is claimed that the earnings of the Ocean Steamship Co., a subsidiary of the Central of Georgia, should be used to help pay interest on the income bonds; also that about $263,000 should be charged to capital account instead of to income, and that $150,000 is being held to satisfy lumbermen's claims for overcharges in a case pending. This latter sum has been charged against earnings of the past year, although the case has been in the courts for the last three years.

Chicago, Rock Island & Pacific.—A quarterly dividend of 1¾ per cent. on the $74,854,100 capital stock has been declared payable October 1; this makes 5¼ per cent. paid so far this year. The rate in 1906 was 6 per cent., in 1905, 6¼ per cent., and in 1904, 8¼ per cent.

Colorado & Southern.—See Denver & Interurban.

Denver & Interurban.—This company, a subsidiary of the Colorado & Southern, has made a first mortgage to the Guaranty Trust Company, New York, securing an issue of $1,250,000 6 per cent. bonds of 1937. The road is under construction from Denver, Colo., to Louisville Junction, 16 miles, and will include two Colorado & Southern lines from that point to Boulder, each about 28 miles long, which are to be electrified.

Erie.—Results of operation for the year ended June 30, 1907, were as follows:

Miles operated	2,169	Inc.	18
Gross earnings	$53,914,827	"	$3,912,195
Operating expenses and taxes	38,167,039	"	2,294,202
Net earnings	$15,747,788	Inc.	$1,617,991
Other income	475,022	Dec.	62,279
Gross income	$16,222,810	Inc.	$1,555,712
Fixed charges	10,319,152	"	668,697
Net income	$5,903,658	Inc.	$887,015
Additions and improvements	1,642,029	Dec.	284,944
Balance available for dividends	$4,261,629	Inc.	$1,171,959
Dividends:			
4 per cent., 1st preferred	$1,915,696		
4 per cent., 2d preferred.	640,000		
	2,555,696		
Surplus	$1,705,933	Inc.	$1,171,959

Los Angeles Pacific (Electric).—It is understood that a mortgage for $20,000 has been made to the Southern Trust Company, Los Angeles, to secure an issue of that amount of bonds, of which $12,000,000 will be used to retire outstanding bonds and the remainder for improvements. The company owns 107 miles of road from Los Angeles to the Pacific ocean, with branches. The improvements include extensions, new rolling stock and power stations, and rock ballasting and relaying the whole line with 90-lb. rails.

Michigan Central.—See St. Joseph, South Bend & Southern.

Ohio Electric Railways Company.—The capital stock of this company has been increased from $100,000 to $25,000,000, half of which is preferred. The dividend rate on the preferred stock is to be 2 per cent. in 1908, 3 per cent. in 1909, 4 per cent. in 1910, and 5 per cent. thereafter. The company is to be a merger of the Schoepf properties, including:—the Cincinnati Northern Traction, the Lima & Toledo Traction, the Indiana, Columbus & Eastern Traction, the Columbus, Buckeye Lake & Newark Traction, the Columbus, Newark & Zanesville Electric, the Dayton, Springfield & Urbana Electric, the Urbana, Bellefontaine & Northern, the Columbus, London & Springfield and the Columbus, Grove City and Southwestern. It is said that the new stock has been subscribed to by Cincinnati and New York interests and that the merger will be completed within two months.

St. Joseph, South Bend & Southern.—The regular semi-annual dividends of 2½ per cent. on the $250,000 preferred and 1 per cent. on the $500,000 common stock have been declared, and also an extra dividend of half of 1 per cent. on the common stock. The same extra dividend was declared in 1905, but not in 1906. The road runs from South Bend, Ind., to St. Joseph, Mich., 39 miles, and is operated by the Michigan Central.

Toledo Railway & Terminal.—According to the report of the Special Master, the recent foreclosure sale of this property brought $2,000,000. The principal and interest on the bonds, together with the expenses of the foreclosure proceedings, amounted to $3,865,021.